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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBER 15
AUGUST 1, 1981

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SELECTED
WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

GEOTHERMAL GRADIENTS IN THE MISSOULA AND BITTERROOT VALLEYS, WEST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. B. Leonard, and W. A. Wood.
Geological Survey Water-Resources Investigations 80-89, November, 1980. 15 p, 7 Fig, 1 Tab, 10 Ref.

Descriptors: *Geothermal studies, Temperature, *Thermal springs, *Thermal water, Thermal conductivity, Heat flow, *Montana, West-central Montana, Missoula Valley, Bitterroot Valley.

Temperature-depth profiles of six cased test holes in the Missoula and Bitterroot Valleys, west-central Montana, consist of linear segments, the intersections of which commonly correspond with lithologic boundaries. Geothermal gradients commonly decreased with depth, probably as a result of compaction and higher quartz content of the deeper sedimentary deposits. There is no evidence for hydrothermal discharge. A maximum temperature of 31.7 degrees Celsius was measured at a depth of 869 meters. Estimated temperatures at a depth of 1 kilometer at the drill sites ranged from about 34 to 63 degrees Celsius. Temperatures exceeding 90 degrees Celsius probably would not occur at depths less than 1,500 meters. Values of thermal conductivity needed to maintain an assumed regional heat flow of about 2.1 heat flow units along the measured geothermal gradients generally exceeded published values for the rock and soil penetrated by the wells. Laboratory determinations of the thermal conductivity of cores and cuttings would be useful to refine the estimates and to test the conclusion that the measured temperatures are not hotter than normal. (USGS)
W81-02930

HYDROLOGY AND GEOCHEMISTRY OF THERMAL GROUNDWATER IN SOUTHWESTERN IDAHO AND NORTH-CENTRAL NEVADA,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young, and R. E. Lewis.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $11.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 80-2043, December, 1980. 40 p, 4 Fig, 6 Tab, 42 Ref, 2 Plates.

Descriptors: *Geochemistry, *Hydrology, *Thermal water, Chemical reactions, Chemical analysis, Aquifer characteristics, Groundwater movement, Water temperature, *Idaho, *Nevada, Thermal springs, Heat flow, Well data, Geothermal studies, Tritium, Stable isotopes, Model studies, Southwestern Idaho, North-central Nevada.

In southwestern Idaho and north-central Nevada, thermal groundwater occurs under artesian conditions in igneous or sedimentary rocks of Tertiary age. Temperatures of the groundwater range from 30 degrees to more than 80 degrees Celsius. Thermal waters are a sodium carbonate or bicarbonate type; nonthermal waters are a calcium bicarbonate. Chemical geothermometers indicate maximum reservoir temperatures near 100 degrees Celsius. Stable-isotope data indicate recharge to the system occurred when climate averaged 3 degrees to 5 degrees Celsius colder than at present; such conditions existed during Holocene glacial advances 3,000 and more than 8,000 years ago. Residence time calculated on the basis of reservoir volume and thermal-water discharge is 3,400 to 6,800 years. Considering estimates of heat flux in and heat discharged by conduction and convection, about 25.0 cubic feet per second, or about 18,000 acre-feet per year, of 50 degrees Celsius water is required to transport excess heat from the system advectively in groundwater. The conceptual model is one where water has circulated thousands, even tens of thousands, of years. Within model constraints, reservoir thermal energy for this geothermal system is 130x10 to the 18th power calories. (USGS)
W81-02990

2. WATER CYCLE

2A. General

EFFECT OF PUMPAGE ON GROUNDWATER LEVELS AS MODELED IN LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. A. Crist.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $17.00 in paper copy, $6.00 in microfiche. Geological Survey Open-File Report 80-1104 (WRI), 1980. 26 p, 12 Fig, 25 Ref, 5 Plates.

Descriptors: *Groundwater, *Pumpage, *Groundwater level, *Withdrawal, Aquifers, Water use, Irrigation wells, Water level fluctuations, Potentiometric level, Groundwater movement, *Model studies, Forecasting, Groundwater development, Water management, Hydrologic data, Maps, *Wyoming, Laramie County.

Groundwater is being extensively developed for domestic, agricultural, and industrial use in a 2,320-square mile area in Laramie County, WY., bounded approximately by Horse Creek on the north, Nebraska on the east, Colorado on the south, and pre-Tertiary outcrops on the west. Currently (1977) about 47,300 acres of land are irrigated with groundwater. Groundwater levels are declining in some areas as much as 4 feet per year. The investigation was made to provide State water administrators with data on water-level changes resulting from present (1977) groundwater withdrawals and to provide a means of predicting the future effect of groundwater development. A digital model was developed of the hydrologic system in the post-Cretaceous rocks. The ability of the model to simulate the hydrologic system was determined by comparing the water-level changes measured at 37 observation wells located in areas of irrigation pumping with the water-level changes calculated by the model for 1971-77. Comparison of the measured and calculated changes showed agreement with a root-mean-square deviation of + or - 3.6 feet with 8 feet as the maximum deviation. It is concluded that the model adequately simulates present hydrologic conditions in the post-Cretaceous rocks and may be used to predict the effect of applied stress to the system. (USGS)
W81-02923

WATER AVAILABILITY AND GEOLOGY OF SUMTER COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02998

AVAILABILITY OF SURFACE WATER IN MONTGOMERY COUNTY, ALABAMA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02999

CALIBRATION AND SENSITIVITY ANALYSIS OF THE STORM CONTINUOUS FLOW SIMULATION MODEL (IN FRENCH),
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. L. Sautier, and J. W. Delleur.
La Houille Blanche No 4/5, p 339-344, April, 1980, 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Urban runoff, *Sensitivity analysis, *Model studies, Simulation analysis, Watershed model, Rainfall-runoff relationships, Urban watersheds.

This study relates to the hourly continuous runoff simulation model STORM. This model provides a substantial improvement over the elementary rainfall-runoff transformations, without being so sophisticated as to become cumbersome, in the practice by consulting engineer offices of small size. Using the composite runoff coefficient method in an urban watershed and in addition, the Soil Conservation Services method for the previous areas in a semi-urban watershed, a methodology is developed to calibrate the parameters characterizing the equations relating to each of these two methods. A sensitivity analysis of the model is done around the calibration values of the parameters. The two methods of analysis show that the yearly total amount of runoff, the total amounts of runoff by storm event and the peaks by event are all good and stable estimates. The choice of the method depends on the percent of imperviousness. In addition, the model STORM calculates hourly hydrograph ordinates. However, for the watershed under study it was not possible to obtain reliable results before the peak time, because of the short time of concentration which was approximately 30 minutes.
W81-03010

BIFURCATION ANALYSIS OF RAINFALL INFILTRATION,
Princeton Univ., NJ. Dept. of Civil Engineering.
V. V. Nguyen, and E. F. Wood.
Water Resources Research, Vol 17, No 1, p 216-222, February, 1981. 9 Fig, 17 Ref.

Descriptors: *Infiltration, *Soil moisture, *Rainfall, Bifurcation analysis, Runoff, Mathematical studies, Precipitation(Atmospheric), Hydrology, Hysteresis, Ponding.

The equation of unsaturated flow is used to analyze the bifurcation (nonlinear) behavior of point infiltration. Results show that in this manner the relationship between infiltrations, rainfall, and soil properties can be better understood, particularly the threshold and hysteresis behaviors observed in the laboratory. A theoretical basis for parameter thresholds in the runoff response operator is developed. Results indicate that the soil moisture at the surface can exhibit a jump phenomenon to saturated during low precipitation rates, resulting in fast formation of areas with surprisingly high runoff rates. Applying these procedures to laboratory studies of Plainfield sand gives results agreeing with previous work. (Cassar-FRC)
W81-03065

2B. Precipitation

STOCHASTIC SIMULATION OF DAILY PRECIPITATION, TEMPERATURE, AND SOLAR RADIATION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
C. W. Richardson.
Water Resources Research, Vol 17, No 1, p 182-190, February, 1981. 6 Fig, 13 Tab, 18 Ref.

Descriptors: *Stochastic processes, *Temperature, *Weather data, *Rainfall, Solar radiation, Mathematical studies, Model studies, Hydrology, Precipitation(Atmospheric), Air temperature, Markov processes, Planning.

Synthetic weather data may be generated by a stochastic method to supply input for studies of long-term effects of man's activities on hydrologic processes. A model was developed which simulates daily precipitation, maximum and minimum temperature, and solar radiation. Simulated precipitation is generated using a Markov chain exponential model; the other three variables by a multivariate model, with the means and standard deviations depending on the wet or dry status as determined by the precipitation. The daily weather samples produced reflect the seasonal and statistical characteristics of each variable, as well as the interrelationships among the four variables, such as heat storage from one day to the next. Weather conditions were simulated for areas in Texas, Georgia, and Washington. Observed and calculated data on rainfall amounts, occurrence of wet days, mean daily temperatures, solar radiation, and

annual extreme temperatures were similar. (Cassar-FRC)
W81-03063

DESIGN OF PRECIPITATION NETWORKS,
National Weather Service, Silver Spring, MD. Hydrologic Research Lab.
E. L. Peck.
Bulletin of the American Meteorological Society, Vol 61, No 8, p 894-902, August, 1980. 2 Fig, 67 Ref.

Descriptors: *Networks, *Rain gages, *Precipitation(Atmospheric), Isohyets, Model studies, Weather data, Remote sensing, Radar, Satellites(Artificial).

A review is presented of research on precipitation variability, and the state-of-the-art in measurement and estimation of atmospheric precipitation is discussed. Isohyetal maps of the average seasonal or annual precipitation for a specified period are a common method of determining long-term spatial variability. Short-term spatial variability is more difficult to model, and methods include Norwegian dynamic weather models, statistical studies of weather data, and satellite data analyses. Research in long-term temporal variability has included a better understanding of the statistics of precipitation data and their application to networks. Short-term temporal variability studies included studies on thunderstorms and models for urban areas. Multisensor (gage, pulse radar, and satellite) networks can be used to obtain improved estimates of precipitation. This type of system requires that detailed studies be made of the uncertainty of each measurement and the development of an objective analysis for combining the data. Coordination is necessary to plan and design precipitation gages throughout the US to obtain useable data. (Small-FRC)
W81-03121

THE MARINE LAYER AT SAN DIEGO, CALIFORNIA, AS RELATED TO SUBSEQUENT COOL SEASON PRECIPITATION FORECASTS IN ARIZONA,
Weather Service Forecast Office, Phoenix, AZ.
I. S. Brenner.
Bulletin of the American Meteorological Society, Vol 61, No 3, p 202-211, March, 1980. 1 Fig, 7 Tab, 5 Ref.

Descriptors: *Precipitation(Atmospheric), *Weather forecasting, *Marine air masses, California, Arizona, Moisture, Moisture availability, Model studies, *Moisture gradient.

The relationship between the moisture concentration within, and the depth of, the marine layer at San Diego, California, and the subsequent atmospheric precipitation during the cool season in Arizona was examined. A moisture parameter related to the depth of the marine layer was used on a real-time basis to predict indirectly, but reliably, the relative magnitude of the current vertical motion field ahead of an approaching trough. A marine layer from the surface to at least 700 mb level was generally necessary for consideration of a subsequent widespread precipitation episode in Arizona. Probabilities of measurable precipitation and combined measurable and trace precipitation probabilities were derived from a data sample. Also, the probability of measurable atmospheric precipitation was applied to an independent data sample, and the Brier scores were compared to Model Output Statistics values. The study indicates that additional high moisture values in the 700-400 mb layer from any source could further enhance the probabilities of precipitation. (Small-FRC)
W81-03122

2D. Evaporation and Transpiration

WATER BUDGET COMPUTATION IN LAKE OKEECHOBEE,
Agricultural Research and Education Center, Belle Glade, FL.
S. F. Shih.
Florida Scientist, Vol 43, No 2, p 84-92, Spring, 1980. 2 Fig, 1 Tab, 6 Ref.

Descriptors: Water budget, *Marshes, *Mathematical models, Lakes, Lake evaporation, *Hydrologic budget, Pan evaporation, *Evaporation rate, Transpiration, Florida, *Lake Okeechobee.

A method was developed to compute the water balance for Lake Okeechobee, and the difference in the sums of stage deviation obtained using conventional and modified methods was compared, with and without considering the marsh zone evapotranspiration. The lake is a major reservoir for storing surface water for South Florida, but the volume of the lake has been inconsistently estimated in the past. Computation of the water budget is difficult because the existing marsh zones can transpire large quantities of lake water, and there are two different types of evaporation pans which can affect the accuracy of estimations of the lake's evaporation. A model was developed which considers the marsh evapotranspiration and evaporation pan differences. This method was more precise in computing the water budget for the lake, and reduced the sum of storage deviation by about 94% compared to the conventional method used for the past 26 years. (Small-FRC)
W81-03100

DAILY FLUCTUATIONS IN WATER POTENTIAL AND ASSOCIATED IONIC CHANGES IN ATRIPLEX CANESCENS,
North Dakota Univ., Grand Forks. Dept. of Biology.
R. W. Ruess, and M. K. Wali.
Oecologia, Vol 47, No 2, p 200-203, 1980. 5 Fig, 2 Tab, 24 Ref.

Descriptors: *Soil-water-plant relationships, *Desert plants, *Plant physiology, Ion transport, Water potential, Atriplex canescens, Drought tolerance, Cold resistance, Evapotranspiration, Diurnal.

Atriplex canescens, a cold-season dioescous shrub inhabiting semiarid and arid regions in the western U.S., was studied in August 1978 near Tipton, Wyoming, to measure water potential under varying conditions. Minimum values (-15.5 bars) coincided with low air and soil temperatures at night; maximum values (-45.1 bars) were found at midday, when evaporative demands were greatest. Changes in water potential appeared to be independent of size, age, sex, and location of plants. At high water potentials, xylem sap was up to 3 times as concentrated as at low water potentials. Sap flowed at a greater rate at low water potentials than at high potentials, accounting for the dilution in concentration of sap solutes. In the expressed sap the concentration of ions in mg per liter was as follows: Ca(+2), 2.75; Mg(+2), 2.20; K+, 7.75; Na+, 0.75; and chloride, 6.30; and the K+ to Na+ ratio was 10.33. This study suggests that some selectivity mechanisms for K+ are operating, and that this operation is maintained by high Ca(2+) concentrations. (Cassar-FRC)
W81-03250

2E. Streamflow and Runoff

SEEPAGE STUDY FOR UNNAMED TRIBUTARY TO ALDER CREEK, STEVENS COUNTY, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
P. J. Carpenter, and B. W. Drost.
Geological Survey Water-Resources Investigations 79-33, 1979. 16 p, 4 Fig, 2 Tab, 2 Ref, Append.

Descriptors: *Streamflow, *Runoff, Water rights, *Seepage, *Irrigation water, Low flow, Base flow, Flow measurement, Specific conductivity, Drainage area, Sites, Climatic data, Water use, Data collections, *Washington, Stevens County, Alder Creek basin.

Analysis of seepage measurements in the Alder Creek basin, Stevens County, Wash., shows that approximately 50% of 0.2 cubic foot per second taken from an unnamed tributary and used for the 1978 irrigation season would have reached Alder Creek as surface flow. Differences in discharge and specific conductance are explained by the basin geology, physical characteristics, climate, and water use. Only general conclusions could be made from data collected for five seepage measurements because irrigation activities could not be scheduled to allow the hydrologic system to reach equilibrium. (USGS)
W81-02916

FEASIBILITY OF USING AN ACOUSTIC VELOCITY METER TO MEASURE FLOW IN THE CHIPPS ISLAND CHANNEL, SUISUN BAY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W81-02921

TECHNIQUES FOR ESTIMATING FLOOD PEAKS, VOLUMES, AND HYDROGRAPHS ON SMALL STREAMS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. D. Becker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-136145, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-80, September, 1980. 82 p, 18 Fig, 5 Tab, 26 Ref.

Descriptors: *Floods, *Streamflow, *Flood forecasting, *Flood peak, *South Dakota, Hydrograph analysis, Streamflow forecasting, Precipitation(Atmospheric), Surface runoff, Storm runoff, Flood frequency, Flood recurrence interval, Rainfall-runoff relationships, Regression analysis, Model studies, Data collections, Gaging stations, Flood data, Estimating.

Procedures are defined for estimating magnitude and frequency of future flood peaks and flood volumes and for estimating hydrograph shape of rainfall-induced runoff of small streams in South Dakota where flood flows are not significantly affected by artificial storage or other manmade activities. For 115 gaged sites, the estimates are from frequency curves defined from the gaging records. Estimates are made for ungaged sites using regression relations based on drainage basin size, main channel slope, and a soil-infiltration index. Estimating relations are applicable for flood peaks on watersheds draining 0.05 to 100 square miles and for flood volumes on watersheds draining from 0.05 to 15 square miles. Limitations on use of the regression relations and the reliability of estimates are discussed. A method is indicated for using the estimating procedures and embankment ponding to design smaller highway culverts. The procedures were developed from analysis of flood records of 123 gaged sites. For 66 sites, short-term records were extended using long-term climatic records and a rainfall-runoff model. Flood magnitudes as dependent variables were related by regression analyses to indexes describing the drainage basins as independent variables. A dimensionless hydrograph shape was found appropriate for rainfall-runoff hydrographs. (USGS)
W81-02929

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1978,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02979

HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS, METROPOLITAN AREA, 1978,
Geological Survey, Fort Worth, TX. Water Resources Div.
B. B. Hampton, and C. M. Wood.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $14.75 in paper copy, $3.50 in microfiche. Geological Survey

Open-File Report 80-1004, September, 1980. 114 p, 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Urban hydrology, *Rainfall-runoff relationships, *Storm runoff, *Urban runoff, Hydrologic data, Small watersheds, Streamflow, Flow rates, Peak discharge, Flood profiles, Watershed management, Texas, *Dallas.

This report contains rainfall and runoff data collected during the 1978 water year for drainage basins of Joes Creek, Bachman Branch, Turtle Creek, Coombs Creek, Cedar Creek, White Rock Creek, Elam Creek, Fivemile Creek, Newton Creek, Whites Branch, Prairie Creek, Tenmile Creek, Duck Creek, and South Mesquite Creek in the Dallas, Texas metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Detailed rainfall-runoff computations are presented for ten storm periods during the 1978 water year. (USGS)
W81-02980

HYDROLOGIC DATA FOR NORTH CREEK, TRINITY RIVER BASIN, TEXAS, 1978,
Geological Survey, Austin, TX. Water Resources Div.
C. C. Kidwell.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-573, August, 1980. 44 p, 2 Fig, 3 Tab.

Descriptors: Hydrologic data, *Streamflow, *Rainfall-runoff relationships, *Retaining walls, *Floodwater, Gaging stations, Discharge(Water), Hydrographs, Mass curves, Flood control, Small watersheds, Texas, *North Creek, *Trinity River basin.

This report contains rainfall and runoff data collected during the 1978 water year for the 21.6-square mile area above the stream-gaging station North Creek near Jacksboro, Texas. A continuous water-stage recording gage was installed at one representative floodwater-retarding structure (site 28-A) on Oct. 5, 1972. The data are collected to compute the contents, surface area, inflow, and outflow at this site. The stream-gaging station on North Creek near Jacksboro continuously records the water level which, with measurements of streamflow, is used to compute the runoff from the study area. Streamflow records at this gage began on Aug. 8, 1956. Detailed rainfall-runoff computations are included for two storm periods during the 1978 water year at the stream-gaging station. (USGS)
W81-02981

WEST VIRGINIA DEPARTMENT OF HIGHWAYS RESEARCH PROJECT 16, 'RUNOFF STUDIES ON SMALL DRAINAGE AREAS' (TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN WEST VIRGINIA),
Geological Survey, Charleston, WV. Water Resources Div.
G. S. Runner.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $6.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1218, October, 1980. 44 p, 24 Fig, 9 Ref.

Descriptors: *Floods, *Natural streams, *Runoff, *Drainage area, Estimating, Flood peak, Flood frequency, Regional analysis, Regression analysis, Frequency analysis, Flood data, Data collections, Stream gages, *West Virginia, Ohio River basin, Potomac River basin.

A technique is presented to provide a method of estimating the magnitude of peak discharges of T-year frequencies for unregulated, virtually natural streams in West Virginia. Multiple regression techniques were used to develop the relation between peak discharges and drainage area. Data collected at 170 stream gaging sites were used in the analyses. Analyses indicated that the best estimating equations could be derived by dividing the State into three regions, regions 1 and 2 covering the Ohio River basin in West Virginia, and region 3 covering the Potomac River basin in West Virginia. The method is applicable for drainage areas between 0.3 and 2,000 square miles. Graphs are provided to estimate the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year flood peaks for drainage areas between 1 and 1,000 square miles. Peak discharges for drainage areas less than 1 or greater than 1,000 square miles can be estimated using the appropriate equations provided on each graph. (USGS)
W81-02985

MAGNITUDE AND CHEMICAL QUALITY OF BASE FLOW OF OTTER CREEK, TONGUE RIVER, AND ROSEBUD CREEK, SOUTHEASTERN MONTANA, OCTOBER 26-NOVEMBER 5, 1977,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02988

AVAILABILITY OF SURFACE WATER IN AUTAUGA COUNTY, ALABAMA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02997

2F. Groundwater

UNSATURATED FLOW IN AN ARID ENVIRONMENT,
Nevada Univ. System, Reno. Water Resources Center.
C. M. Case.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202061, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41070, January, 1981. 52 p, 5 Fig, 32 Ref. OWRT-A-068-NEV(1), 14-34-0001-6029.

Descriptors: *Unsaturated flow, *Arid lands, *Mathematical models, *Thermodynamics, *Theoretical analysis, Soil water, Soil water suction, Flow, Arid climates, Climates, Arid zone, Equilibrium, Soil water potential, Capillary water, Available water, Hygroscopic coefficient, Soil moisture deficiency, Soil adsorption capacity, Groundwater, Groundwater availability, Model studies.

Unsaturated flow of water in an arid environment requires a more exacting application of theory/experiment than needed in irrigated agriculture, which heretofore has been the principal motivation for developing unsaturated flow understanding in the US. Such unsaturated flow has been described on a theoretical basis, including nonequilibrium and equilibrium thermodynamics, and a concept of using the pore radius frequency distribution as an averaging kernel for computing physical quantity averages depending on pore-capillary radii. Unsaturated flow chemistry occurs explicitly in both the surface tension of the water containing impurities and in the interfacial energy of the water interstitial soil-water interfaces. Spreading pressure concepts were introduced in this connection, and the suction/saturation hysteresis phenomenon was assessed in terms of equilibrium thermodynamics. Further, since nonequilibrium thermodynamics furnishes the correct and complete equation set for unsaturated flow description, more attention should be devoted to phenomenological coefficient measurements and to a systematic study of the numerical solution of the coupled, nonlinear partial differential equations necessarily arising in such a formulation. (Zielinski-IPA)
W81-02911

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF SOUTHEASTERN MASSACHUSETTS, NORTHWEST SHORE OF BUZZARDS BAY,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02917

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF NORTHEASTERN MASSACHUSETTS, FROM CASTLE NECK RIVER, IPSWICH, TO MYSTIC RIVER, BOSTON,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02918

EFFECT OF PUMPAGE ON GROUNDWATER LEVELS AS MODELED IN LARAMIE COUNTY, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W81-02923

SAMPLE DESCRIPTIONS FOR TEST WELLS PENETRATING DEEP AQUIFERS IN DALLAS AND SUMTER COUNTIES, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
For primary bibliographic entry see Field 6B.
W81-02927

APPRAISAL OF THE WATER RESOURCES OF THE BIG SIOUX AQUIFER, BROOKINGS, DEUEL, AND HAMLIN COUNTIES, SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
N. C. Koch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-164584, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-100, October, 1980. 46 p, 13 Fig, 7 Tab, 23 Ref.

Descriptors: *Groundwater resources, *Aquifers, *Computer models, *Simulation analysis, Aquifer characteristics, Wells, Water level fluctuations, Surface-groundwater relations, Evapotranspiration, Water quality, Chemical analysis, Water resources development, *South Dakota, Brookings County, Deuel County, Hamlin County.

A finite-difference method digital model was used to simulate steady-state conditions of the Big Sioux aquifer in Brookings, Deuel, and Hamlin Counties, S. Dak. Average annual water levels in the Big Sioux aquifer and average base flow discharge 58 cubic feet per second on the Big Sioux River near Brookings were based on the period 1970 through 1976. The computer model was used to model transient conditions by simulating monthly periods from April through August 1976. Evapotranspiration and pumpage changes were made for each month. A computer simulation was made without irrigation pumpage which resulted in an increase in the base flow from 0.66 to 9 cubic feet per second for August 1976 in the Big Sioux River near Brookings. Two transient simulations, one with the drought conditions of 1976 and one using all the pumpage allowed by irrigation permits approved by the State as of February 1979 showed, as a result of pumpage, that there was a decrease in evapotranspiration and a decrease in discharge to streams which amounts to 26 and 31% of the total groundwater pumped. Groundwater and surface water in the study area are primarily calcium bicarbonate types and are chemically suitable for irrigation with respect to sodium hazard. Sepcific conductance of groundwater ranged from 407 to 1,790 micromhos per centimeter at 25 Celsius. (USGS)
W81-02932

LITHOLOGIC LOGS AND GEOPHYSICAL LOGS FROM TEST DRILLING IN PALM BEACH COUNTY, FLORIDA, SINCE 1974,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02983

WATER-LEVEL DATA FOR WELLS IN BURIAL GROUND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1975-1979,

Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 5E.
W81-02989

SURFICIAL GEOPHYSICAL DATA FOR TWO CROSS-VALLEY LINES IN THE MIDDLE EAGLE RIVER VALLEY, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
L. L. Dearborn, and D. H. Schaefer.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $2.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-2000, 1981. 14 p, 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Resistivity, *Seismic waves, *Alaska, *Glaciation, *Groundwater potential, Stratigraphy, Data collections, Bedrock, Traveltime, Computer programs, Anchorage area, *Eagle River valley.

In 1979, six electrical resistivity and four seismic refraction soundings were made in the middle reach of the Eagle River valley northeast of Anchorage, Alaska. Interpretation of the geophysical data collected indicated that depth to bedrock below the valley floor varies between about 350 and 450 feet. Two, and perhaps three, major unconsolidated sedimentary layers are inferred to overlie bedrock, although other significant layers may not have been recognizable. No prior subsurface data were available in this area. A resistivity sounding was made also at a site about 7 miles downstream to explore for a buried bedrock channel. The data here indicated that the bedrock surface is about 50 feet above sea level. Hence, the hypothesis of a buried ancient outlet valley of Eagle River at this location gained more credence. (USGS)
W81-02993

WATER-LEVEL MAP OF THE MISSISSIPPI DELTA ALLUVIUM IN NORTHWESTERN MISSISSIPPI, SEPTEMBER 1980,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02996

OSMOTIC MODEL TO EXPLAIN ANOMALOUS HYDRAULIC HEADS,
Du Pont de Nemours (E. I.) and Co., Aiken, SC. Savannah River Lab.
I. W. Marine, and S. J. Fritz.
Water Resources Research, Vol 17, No 1, p 73-82, February, 1981. 8 Fig, 2 Tab, 30 Ref.

Descriptors: *Osmosis, *Hydraulic gradient, *Membranes, Clays, Ion transport, Pressure head, Saline waters, Water pressure, Osmotic pressure, Pressure, Savannah River, South Carolina, Aquifers, Coastal plains, Wells, Equilibrium, Model studies, Groundwater movement, Hydraulic heads.

In a buried Triassic basin near the Savannah River, South Carolina, saline water in the basin center is slightly geopressurized with respect to fresh water in the overlying coastal plain aquifer. Two wells have heads of 7.88 and 12.98 bars (114.3 and 188.3 psi) greater than the coastal plain aquifer head. The head in each of these wells approximates the osmotic equilibrium head, calculated from the solution concentration of water produced by each well (12,000 and 18,500 mg per liter, respectively). Other non-geopressurized wells in the top and edge of the basin probably penetrate a zone where ion leakage produces less saline water. Although compacted clays act as osmotic membranes when they separate solutions of unequal ion concentrations, in natural systems both membranes and solution containers are indistinct and not well defined. In addition, the membranes are thick, inhomogeneous, and composite. The authors explain the anomalous heads in this basin as follows: previous hydrogeochemical processes produced the saline groundwater, and fresh water passed into the Triassic rock by osmosis until equilibrium was reached. The freshwater influx decreases the salinity of water in the margins of the basin, lowering osmotic pressure and isolating an osmotic cell in the center of the basin. The cell will 'run down' as fresh water moves inward and salt leaks outward, depending on the rate of movement and total supply of salt in the rocks. (Cassar-FRC)
W81-03058

A TECHNIQUE IN USING INTEGRODIFFERENTIAL EQUATIONS FOR MODEL SIMULATION OF MULTIAQUIFER SYSTEMS,
Asian Inst. of Tech., Bangkok (Thailand).
J. Premchitt.
Water Resources Research, Vol 17, No 1, p 162-168, February, 1981. 7 Fig, 17 Ref.

Descriptors: *Aquifers, *Model studies, *Groundwater basins, Aquitards, *Groundwater movement, Drawdown, Hydrogeology, Mathematical studies.

A multiaquifer model with quasi-three-dimensional character is developed. It takes account of the direct flow across the aquitard and the yield from aquitard storage in leakage flux terms in the form of convolution integrals. This model can be used for any number of aquifers or aquitards, different types of boundary geometry and boundary conditions, and any arbitrary pumping schedule. Mathematical formulation results in flow functions which diminish with time and can be approximated by a few exponential terms. This technique is more economical (requiring simpler techniques, less data preparation, and less computer time) than the full three-dimensional model or the quasi-three-dimensional models that use one-dimensional elements to represent the aquitards. Model results are compared with an analytical solution by Neuman and Witherspoon (1969) with good agreement, except for discrepancies at early time for drawdown in the pumped aquifer at locations very close to the pumping well and in very thick aquitards. (Cassar-FRC)
W81-03061

FLOW THROUGH FRACTURES,
Geological Survey, Reston, VA.
C. E. Neuzil, and J. V. Tracy.
Water Resources Research, Vol 17, No 1, p 191-199, February, 1981. 11 Fig, 14 Ref.

Descriptors: *Flow rates, *Fracture permeability, *Rock properties, Permeability, Model studies, Hydraulics, Compressible flow, Mathematical studies, Poiseuille flow, Groundwater movement.

A model for water flow through rock fractures is proposed. This represents the fracture by a set of parallel plate openings with different apertures, leading to a modified Poiseuille equation. Although flow through fractures is often described as flow between two parallel plates, this idealized conception does not consider the fact that rock fractures have irregular walls and variable apertures. The proposed model assumes a normal form of aperture distribution. Flowpaths are represented by an opening which varies continuously normal to the flow but with constant aperture in the flow direction. The model allows calculation of flow rate as a function of mean aperture in cases of compression (fracture walls deforming) and extension (fracture walls separating). (Cassar-FRC)
W81-03064

EARTH FISSURES AND LOCALIZED DIFFERENTIAL SUBSIDENCE,
Geological Survey, Menlo Park, CA.
T. L. Holzer, and E. H. Pampeyan.
Water Resources Research, Vol 17, No 1, p 223-227, February, 1981. 6 Fig, 20 Ref.

Descriptors: *Fissures(Geologic), *Land subsidence, Withdrawal, Strain measurement, *Groundwater, Bench marks, Stress analysis, Environmental effects, Compaction, Water table, *Drawdown, Arizona, California, Nevada.

Long, linear earth fissures produced by groundwater withdrawal from unconsolidated deposits were surveyed at four sites--two in south-central Arizona, and one each in Fremont Valley, California, and Las Vegas Valley, Nevada. These fissures occurred near points of maximum convex upward curvature in subsidence profiles oriented perpendicular to the cracks. The authors concluded that the mechanism was horizontal strains induced by localized differential subsidence, which in turn was caused by differential compaction. Profiles were based on measurements with tape or electronic distance meter between closely spaced bench marks. (Cassar-FRC)
W81-03066

A NUMERICAL INVERSION OF THE LAPLACE TRANSFORM SOLUTION TO RADIAL DISPERSION IN A POROUS MEDIUM,
Geological Survey, Menlo Park, CA.
A. F. Moench, and A. Ogata.
Water Resources Research, Vol 17, No 1, p 250-252, February, 1981. 2 Fig, 10 Ref.

Descriptors: *Laplace equation, *Porous media, *Groundwater movement, Equations, Mathematical studies, Permeability, Dispersion, Diffusion.

The Stehfest (1970) numerical inversion of the Laplace transform is applied to the transformed solution of dispersion in a radial flow system in a porous medium. Since the weighting coefficients depend only on the number of terms used in the computation and not upon the transform solution, the calculations are simple enough to be solved on a hand-held programmable calculator. Results using this method compared well with curves obtained by Hoopes and Harleman (1967) with a finite difference scheme. (Cassar-FRC)
W81-03070

PUMPING TEST ANALYSES FOR LOW YIELD FORMATIONS,
UOP Inc., St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 7B.
W81-03229

RESTORING WELLS IS NO GAMBLE IN LAS VEGAS,
For primary bibliographic entry see Field 3B.
W81-03230

THEY'RE IN HOT (GEOTHERMAL) WATER IN BOISE,
Department of Energy, Washington, DC.
P. Cargo.
Johnson Drillers Journal, Vol 52, No 6, p 8-10, November/December, 1980.

Descriptors: *Geothermal studies, *Thermal water, *Heating, Energy, Water use, Groundwater, *Boise, Idaho.

Current plans for expanding use of geothermal water (170F) in Boise, Idaho, include addition of 10 to 13 downtown buildings and 1,000 residences to the system. Other possible uses of this naturally heated water are dehydration of the potato crop, sanitizing equipment, generation of electricity, extraction of oils from plants, destroying roots in the sewage system, and greenhouse heating. Spent, still warm, water can be used for irrigation, aquaculture, and heating animal cages at the zoo. Unknown negative factors are land subsidence, corrosive minerals, and heat pollution of rivers. (Cassar-FRC)
W81-03231

2G. Water In Soils

A NEW METHOD ALLOWING THE MEASUREMENT OF RAPID VARIATIONS OF THE WATER CONTENT IN SANDY POROUS MEDIA,
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
N. T. Hoa.
Water Resources Research, Vol 17, No 1, p 41-48, February, 1981. 12 Fig, 1 Tab, 4 Ref.

Descriptors: *Porous media, *Optical properties, *Sand, Fluid mechanics, *Soil moisture, Porosity, Unsaturated flow.

A new method based on the variation of the factor of light transmission through a heterogeneous solid-liquid-air medium with water content allows measurement of rapid changes of water content in sandy porous media. In this optical method, calibration is an inconvenience. It must be repeated for each photosensitive probe and porous sample, because the number of pores filled with water as a function of water content is unknown and the relationship between light transmission and water content cannot be predicted theoretically. This method is not applicable to a porous material with a very high light absorption modulus. The apparatus is low cost, small, produces quick results, and permits setups with numerous probes. Comparisons with the gamma ray absorption method produced good agreement. (Cassar-FRC)
W81-03054

A TRAVELING WAVE SOLUTION TO THE PROBLEM OF SIMULTANEOUS FLOW OF WATER AND AIR THROUGH HOMOGENEOUS POROUS MEDIA,
Cold Regions Research and Engineering Lab., Hanover, NH.
Y. Nakano.
Water Resources Research, Vol 17, No 1, p 57-64, February, 1981. 16 Ref.

Descriptors: *Soil physics, *Porous media, *Traveling wave solution, Hydraulic models, Model studies, Unsaturated flow, Flow characteristics, Capillary action, *Soil water movement.

A traveling wave solution was developed for the problem of vertical and simultaneous flow of water and air through homogeneous, porous media. Generally, the properties of the solution depend on the hydraulic characteristics of a given problem. The properties of the solution are given for a specific case in which the hydraulic characteristics are supplied in specific functional forms. For this case a singularity always occurs in the physically meaningful solution at both a saturated-unsaturated boundary and a wetting front, and both the saturated-unsaturated boundary and the wetting front can be interpreted as propagating acceleration waves of the Nth order, where N is a positive integer. The soil is infinitely differentiable except in the neighborhood of the saturated-unsaturated boundary and the wetting front, and these singular interfaces may be treated as moving boundaries. The Green-Ampt solution accurately approximates the traveling wave solution if the thickness of the unsaturated zone is very small. (Cassar-FRC)
W81-03056

A THEORETICAL ANALYSIS OF INTERFLOW OF WATER THROUGH SURFACE SOIL HORIZONS WITH IMPLICATIONS FOR MOVEMENT OF CHEMICALS IN FIELD RUNOFF,
Science and Education Administration, Durant, OK. Southern Plains Watershed and Water Quality Lab.
L. R. Ahuja, J. D. Ross, and O. R. Lehman.
Water Resources Research, Vol 17, No 1, p 65-72, February, 1981. 13 Fig, 16 Ref.

Descriptors: *Subsurface runoff, *Soil water movement, *Agricultural chemicals, Slopes, Runoff, Subsurface flow, Water pollution, Topsoil, Permeability, Darcys law, Subsoil, Soil horizons, Saturated flow, Flow, Path of pollutants.

A theoretical analysis examines the nature and extent of subsurface flow, or interflow, through soils and the movement of agricultural chemicals to field surface runoff. Solutions are obtained for cases of interflow in a sloping layered soil having a subsoil of low permeability. Relationships are developed between relative permeability and depth of the subsoil above an impermeable base and different ratios of slope length to soil profile depth. In another case flow through topsoil is saturated and steady, with a constant downward flux of water uniformly over all its area. Results show that the interflow through each horizon of a layered soil profile can be approximated by a one-dimensional Darcian flow parallel to the slope for ratios of slope length to soil profile depth greater than 6 to 10. For the extreme case of a sloping soil with semi-infinitely deep subsoil on an impermeable base, the interflow through the topsoil can be treated as a one-dimensional flow if the soil is highly conductive. In these cases, the movement of soil chemicals with interflow is a one-dimensional miscible displacement process. The cross section of the topsoil through which the interflow moves and picks up its chemical load is drastically reduced by downward leakage even when the subsoil conductivity is 2 orders of magnitude smaller than that of the topsoil. By representing this wedge-shaped area by an equivalent rectangle, the chemical movement may still be approximated as a one-dimensional displacement. (Cassar-FRC)
W81-03057

PHYSICALLY BASED PROBABILISTIC MODELS OF INFILTRATION, SOIL MOISTURE, AND ACTUAL EVAPOTRANSPIRATION,
Simon Bolivar Univ., Caracas (Venezuela).
J. R. Cordova, and R. L. Bras.
Water Resources Research, Vol 17, No 1, p 93-106, February, 1981. 16 Fig, 6 Tab, 13 Ref.

Descriptors: *Evapotranspiration, *Infiltration, *Model Studies, Stochastic processes, *Soil moisture, *Irrigation efficiency, Mathematical studies, Corn, Colorado, Decision making, Probability.

Irrigation with a finite amount of water requires an understanding of the crop response to water application throughout the irrigation season. This paper develops analytical probabilistic models for the components of the soil water balance that influence irrigation decisions--infiltration, soil moisture, and evapotranspiration--using climatic and soil parameters. This stochastic input is used with a physical-conceptual model of the soil moisture depletion process to derive analytic expressions for the soil moisture transition probabilities over a given time period and the first two moments of associated actual evapotranspiration. Model results, compared with a case study involving an early corn variety growing near Colorado State University, accurately represent the observed crop-soil interactions. A future paper will describe the use of derived expressions in an optimal decision model for deficit irrigation practices. (Cassar-FRC)
W81-03059

COMMENT ON 'ANALYSIS OF WATER AND HEAT FLOW IN UNSATURATED-SATURATED POROUS MEDIA' BY MARIOS SOPHOCLEOUS,
Geological Survey, Menlo Park, CA.
W. N. Herkelrath.
Water Resources Research, Vol 17, No 1, p 255-256, February, 1981.

Descriptors: *Soil moisture movement, *Diffusion, Porous media, Geothermal studies.

The author indicates that Sophocleous (1979) used an incorrect derivation to deduce a modified form for the liquid thermal diffusion coefficient in the equation for nonisothermal moisture flow in soil. As a result, as temperature increases, soil moisture potential at constant moisture content decreases, which conflicts with experimental data. Sophocleous replies that his derivation is valid because the work concerned liquid-vapor equilibrium in soils. In addition, some researchers have produced experimental results opposite to those mentioned above. (Cassar-FRC)
W81-03085

THE DETERMINATION OF SOIL-WATER DESORPTION CURVES FOR SOIL CORES,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. P. Stakman.
Canadian Journal of Soil Science, Vol 60, No 4, p 793-795, November, 1980.

Descriptors: *Soil moisture retention, *Model studies, Graphical methods, Mathematical studies, Interstitial water, Soil physical properties, Soil porosity, Soil types.

In this letter to the editor, the author makes reference to an improved method for measuring soil moisture retention curves which had recently been published. The newer method calls for the use of glass beads and A1203 in place of the sand and kaolin used in the more widely known methods. The current author addresses three major problems with the sand and kaolin box method that had been suggested by the authors of the improved method: that sand and kaolin have too low saturated hydraulic conductivity for efficient use, that air entrapment occurs between sand and kaolin, and that large sample size and poor contact between soil and tension medium occur. A reply to this letter by the authors of the improved method is also published. (Baker-FRC)
W81-03232

2H. Lakes

RANGE ANALYSIS OF EXCHANGEABLE NORMAL VARIABLES,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 4A.
W81-03067

DIURNAL VARIATION OF SELECTED PARAMETERS UNDER WATERHYACINTHS AND IN OPEN WATER,
University of South Florida, Tampa. Dept. of Biology.
T. N. Cooley, and D. F. Martin.
Florida Scientist, Vol 43, No 1, p 26-32, Winter, 1980. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Water hyacinth, *Iron, *Diurnal distribution, Lakes, Nutrients, Water properties, Water quality, Carbon, Phosphorus, Nitrogen, Florida.

The effect of waterhyacinths on the physicochemical characteristics of the water column including iron content was investigated in a southwestern Florida lake. Samples were collected under dense hyacinths and in open water. The following measurements were made: temperature, dissolved oxygen, and pH; samples were analyzed for: total dissolved carbon, inorganic carbon, total iron, phosphate-phosphorus, and nitrate-nitrite nitrogen. Diurnal variations in the physico-chemical characteristics were examined. At both sites, temperature, pH, and dissolved oxygen peaked at 1400 hours, while inorganic carbon, carbon, iron, and phosphate-phosphorus peaked between midnight and 0200 hours. There were some differences at the two sites. Dissolved inorganic carbon was unusually higher under the mat than in open water. Iron concentration exhibited a bimodal increase under the mat from 1400-2200 hours and from 0200-0800 hours, but increased at the open water site from 2400-0600 hours. Phosphate-phosphorus increased from 2200 hours to midnight under the mat, but at the open water site increases occurred until 0600 hour. Correlations between data were determined and indicated that a more rapid turnover of iron occurs within the micro-environment of the waterhyacinth covered water column. (Small-FRC)
W81-03101

DECOMPOSITION PROCESSES IN THE PROFUNDAL REGION OF BLELHAM TARN AND THE LUND TUBES,
Freshwater Biological Association, Windermere (England).
J. G. Jones, and B. M. Simon.
Journal of Ecology, Vol 68, No 2, p 493-512, July, 1980. 10 Fig, 3 Tab, 47 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Lakes, Profundal zone, Sedimentation, Respiration, Degradation(Decomposition), *Water pollution effects, Sediments, Methane, Stratification, Nitrogen compounds, Phosphorus compounds, Silicates, Algae, Carbon dioxide, Denitrification, Aerobic conditions, Organic matter, Decomposing organic matter, Lakes, Blelham Tarn, Cumboia.

Decomposition processes (oxygen and nitrate uptake; CO2, methane, ammonia, and sulfide accumulation; methane and nitrogen loss; and C and N input as sedimentary material) were studied in Blelham Tarn and in 2 Lund tubes. The profundal zone, described as the sediment and the overlying 5 meters of water, was the region of interest. One of the experimental tubes received weekly applications of fertilizers--nitrate, phosphate, silicate, and iron. In the fertilized tube, sediment input was greater, decomposition more rapid, and anaerobic respiration proportionally more important than in the unfertilized tube. Several processes proceeded more rapidly than in the open tarn. Sources of CO2 accumulating in the profundal zone were similar in tarn and in both tubes--aerobic respiration 42%, denitrification 17%, sulfate reduction 2%, methanogenesis 25%, and possibly fermentation, the remainder. (Cassar-FRC)
W81-03196

PRIMARY PRODUCTION IN LAKES ROTORUA, REREWHAKAAITU, AND ROTOITI, NORTH ISLAND, NEW ZEALAND, 1973-78,
Ministry of Agriculture and Fisheries, Wellington. (New Zealand). Fisheries Research Div.
A. M. R. Burnet, and J. M. Davis.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 3, p 229-236, 1980. 1 Fig, 3 Tab, 19 Ref.

Descriptors: *Primary production, *Carbon radioisotopes, *Lakes, Oxygen depletion, Seasonal, Eutrophication, *New Zealand.

Primary production was measured by the C-14 method in three New Zealand lakes: Rotorua, Rerewhakaaitu, and Rotoiti. The results of laboratory incubations of water samples were combined with chlorophyll alpha, extinction coefficient, and isolation data using a computer mode. Average annual carbon production rates were determined. Lake Rotorua's was 2.3 gm/sq m/day, Lake Rerewhakaaitu's was 2.2 gm/sq m/day, and Lake Rotoiti's was 1.1 gm/sq m/day. Lake Rotorua had maximum production in summer or early autumn, while Lake Rerewhakaaitu had maximum production in autumn, and Lake Rotoiti in winter. The results suggest that if standards for levels of eutrophication could be set, the level for each lake should probably take into account the physical characteristics of the lake and possible weather variations. Estimates of production in larger lakes even with the aid of the Fee model require many field observations. (Small-FRC)
W81-03222

THE LITTORAL BOTTOM FAUNA OF HIGH ELEVATION LAKES IN KINGS CANYON NATIONAL PARK,
California Univ., Berkeley. Dept. of Forestry and Resource Management.
For primary bibliographic entry see Field 5C.
W81-03223

HYPOLIMNION OXYGEN CONSUMPTION IN LAKES: DISCUSSION OF PRODUCTIVITY AND MORPHOMETRY EFFECTS,
National Water Research Inst., Burlington (Ontario).
M. N. Charlton.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 10, p 1531-1539, October, 1980. 7 Fig, 2 Tab, 34 Ref.

Descriptors: *Lakes, *Hypolimnion, *Productivity, Phytoplankton, Dissolved oxygen, Mathematical studies, Oxygen, *Great Lakes, Lake Erie, Limnology, Lake morphology, Temperature, Chlorophyll, Organic matter, Lake Superior, Lake Michigan, Lake Ontario, Georgian Bay, East Erie, *Oxygen depletion.

Hypolimnion oxygen is a function of thickness and temperature, as well as biological productivity, according to a mathematical relationship developed in this paper. When the equation was applied to Lake Erie, it explained the previously observed anomaly that phytoplankton production was similar in areas of deep and shallow hypolimnion, but oxygen depletion was twice as rapid in the shallow section. Calculated and observed data were in agreement for Lakes Superior, Ontario, Michigan, Georgian Bay and East Erie. (Cassar-FRC)
W81-03224

THE ROLE OF FISHES IN THE REGULATION OF PHOSPHORUS AVAILABILITY IN LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
B. S. Nakashima, and W. C. Leggett.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 1, p 1540-1549, October, 1980. 3 Fig, 7 Tab, 41 Ref.

Descriptors: *Lakes, *Fish, *Phosphorus compounds, Seston, Zooplankton, Ecology, Nutrients, Lake Memphremagog, Yellow perch, Phosphates, Animal physiology, Sedimentation, Aquatic life.

Phosphorus excreted by the fish population in Lake Memphremagog, Quebec, was negligible (less that 0.33%) compared with the demand by the seston. This observation is contrary to Lamarra's (1975-1976) hypothesis that fish excretion is a major source of nutrients in a lake. Likewise, the conclusions do not support the Kitchell, et al. (1975) hypothesis that nutrient excretion by fishes may support plankton populations during periods of low phosphorus availability. Zooplankton excretion was calculated to be 5-12% of the phosphorus taken up by the seston. Total P contents of the seston, cladocerans, and fish population were presented in curves. All reached maxima (in mg per cu meter) in July-August, amounting to about 16-27, 8, and 12-20 respectively. The maximum estimate of daily removal of P from the epilimnion by fish through assimilation into tissue and sedimentation was 0.3-0.8%, or 15-40% of daily sestonic P losses. The lower limit would be more accurate in the case of this lake, where fish redistribute particulate phosphorus tied up in prey. The upper limit would apply if the population was entirely obligate planktivores. In the south basin in spring, decomposition of dead fish during post spawning mortality supplied up to 20% of the P entering the lake water. (Cassar-FRC)
W81-03226

DEPRESSION OF PRIMARY PRODUCTIVITY BY HUMIC MATTER IN LAKE AND RESERVOIR WATERS OF THE BOREAL FOREST ZONE,
Fisheries and Marine Service, Winnipeg (Manitoba).
T. A. Jackson, and R. E. Hecky.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 37, No 12, p 2300-2317, December, 1980. 9 Fig, 13 Tab, 60 Ref.

Descriptors: *Humic acids, *Primary productivity, *Lakes, Reservoirs, Productivity, Stagnant waters, Forest watersheds, Iron, Water pollution effects, Phytoplankton, Algae, Organic matter, Chelation, Manitoba, Nutrients, Impoundments.

Water samples from backwaters and faster-moving waters of three reservoirs and a natural lake in northern Manitoba were studied to determine the influences of humic matter on primary productivity. Stagnant backwater areas, richer in humic matter, were less productive than the more rapidly flushing waters. Total dissolved carbon (less than 0.45 micrometers) and non-dialyzable dissolved iron, organic carbon, nitrogen, and H-bonded polymeric hydroxyl groups were all inversely related to primary production. Results suggest that humic matter depresses productivity by sequestering iron, not by lowering pH, attenuating light, or sequestering phosphate. The reservoirs under study varied in age from 6 months to 14 years. Three distinct stages of chemical and trophic level were apparent. Shortly after impoundment, productivity increased because nutrients were rapidly leached from the newly submerged soil; high levels of nutrients appeared in the backwaters. As humic matter accumulated, productivity decreased, even in the presence of adequate P and N levels, because of trace metal chelation. A steady state, in which productivity again increased, developed when sedimentation and flushing removed the excess humic matter. (Cassar-FRC)
W81-03227

SEASONAL VARIATION OF HETEROTROPHIC POTENTIAL IN LAKE ROTOROA,
Cawthron Inst., Nelson (New Zealand).
P. A. Gillespie, and M. J. Spencer.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 15-21, 1980. 5 Fig, 2 Tab, 26 Ref.

Descriptors: *Trophic level, *Lakes, Lake beds, Lake Rotoroa, Distribution patterns, Seasonal, Oligotrophy, Nutrients, Metabolism, Organic compounds, Phytoplankton, *New Zealand.

The seasonal pattern and range of heterotrophic potential was investigated in a pristine New Zealand lake and related to other physical, chemical and biological parameters describing the ecology of the lake. The lake selected for study was Lake Rotoroa, a warm monomictic lake located in the Nelson Lakes National Park, South Island. It is completely surrounded by native forest with little nutrient enrichment due to man's activities. A 20-fold seasonal variation in heterotrophic potential for glucose uptake was noted during the three year sampling program. Maximum surface water temperature appeared to coincide with peaks in activity. However, large variations suggest quantitative or qualitative changes in the population of the microbes. Values taken from subsurface samples within dense beds of Elodea canadensis were 9 times greater than those taken in surface samples from above the beds. A trend toward decreasing ATP concentrations was noted in summer from 1973 to 1975. (Baker-FRC)
W81-03235

RELATIVE IMPORTANCE OF MICROFLORA AND ALLOPHANIC CLAYS TO THE PHOSPHORUS DYNAMICS OF LAKE REREWHAKAAITU,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
E. White, and G. W. Payne.
New Zealand Journal of Marine and Freshwater Research, Vol 14, No 1, p 83-85, 1980. 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Trophic level, *Lakes, *Distribution pattern, Lake Rerewhakaaitu, *New Zealand, Bottom sediments, Clay, Cycling nutrients, Phytoplankton, Phosphorus.

The relative importance of allophanic clays and microflora for the flux of phosphorus in Lake Rerewhakaaitu in New Zealand was examined. At the time of sampling the water contained between 1.0 and 1.1 mg/square meter dissolved reactive phosphorus and had a chlorophyll-a content of 8.8 mg/cubic meter. Over a 21 hour period the average rate of removal of phosphorus from solution in the water containing living algae and bacteria was 3.2 mg/cubic meter/hr, while phosphorus removal from the water with bacteria and algae killed by freezing averaged 2.7 mg/cubic meter/hr. When the biota had been killed with formaldehyde the removal rates of phosphorus were slow. Phosphorus removal by living organisms was significant in Rerewhakaaitu water and Okaro water, but was not significantly different from abiotic uptake in Rotorua water. Minute quantities of radioactive phosphate-phophorus added to the three lake waters indicated that the removal of 32P from solution was very rapid in Lake Rerewhakaaitu, slow from Lake Rotorua, and between the two for Lake Okaro. When biota had been killed with formaldehyde there was very little removal. (Baker-FRC)
W81-03236

2I. Water In Plants

IMPACT OF WATER LEVEL CHANGES ON WOODY RIPARIAN AND WETLAND COMMUNITIES, VOLUME VIII, PACIFIC NORTHWEST AND ROCKY MOUNTAIN REGIONS,

Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
M. A. Walters, R. O. Teskey, and T. M. Hinckley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-166878, Price codes: A04 in paper copy, A01 in microfiche. Fish and Wildlife Service, Office of Biological Service, Report FWS/OBS-78/94, July, 1980. 53 p, 12 Fig, 4 Tab, 32 Ref. SFWB140276 USDI 92365-0110.

Descriptors: *Water level fluctuations, *Riparian vegetation, *Floods, *Drought resistance, Runoff, *Wetlands, Shrubs, Trees, Mountains, Succession, Pacific Northwest, Rocky Mountain Region.

Riparian vegetation in the Pacific Northwest and Rocky Mountain regions of the western United States is exposed to large fluctuations in water levels. Spring run-off and summer droughts result in large changes in the water status of the vegetation that occupies the riparian zone. Coupled with natural fluctuations in water levels are man originated fluctuations. This volume covers the mountainous areas of the Pacific Northwest from northern California through Washington and Oregon and along the Rocky Mountains from Montana and Idaho extending south through New Mexico and Arizona. The riparian zones in these mountainous regions consist of either narrow interrupted bands along streams, or continuous bands in broad mountain valleys. Forest succession in the riparian zones results in dramatic differences in species composition with different terrace levels. The key to the distinctions of the riparian zones and terrace development is the catastrophic events, floods, which tend to renew zones of early successional species repeatedly. Adaptations to flooding are necessary for the early successional stages. Since arid conditions are frequent in this area, drought resistance is also important for woody plants in this area. Root distribution, soil characteristics, stage of development of the tree, and stomatal closure are all important when evaluating how a species or a plant community will react to drought. (Moore-SRC)
W81-02939

PATHOGENICITY OF CERCOSPORA RODMANII CONWAY ON EICHHORNIA CRASSIPES (MART.) SOLMS IN NATCHITOCHES PARISH, LOUISIANA,
Northwestern State Univ. of Louisiana, Natchitoches. Dept. of Biological Sciences.
S. M. Laborde.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203093, Price codes: A03 in paper copy, A01 in microfiche. MS Thesis, April, 1980, 39 p. OWRT-A-049-LA(1).

Descriptors: *Water hyacinth, Eichhornia crassipes, *Pathogens, Cercospora rodmanii, *Plant diseases, Natchitoches Parish, *Louisiana, Plant pathology, Nutrient requirements, Plant growth, Cultures, Agars.

This investigation was conducted to determine the mode of entry and early pathogensis of Cercospora rodmanii Conway on Eichhornia crassipes (Mart.) Solms, the water hyacinth. Studies were conducted in laboratory aquaria and the field by inoculating plants with a cultured live mycelia inoculum. Infection occured on host plants which were under stress from crowded populations and lack of one or more nutrients. Mode of entry was accomplished by penetration of single hyphae through opened stomata where subsequent sporodochia were produced on the flowering stage of host plants. V-8 agar, cornmeal + V-8 agar, and water hyacinth agar were formulated for vegetative growth and sporulation media for Cercospora rodmanii. Colonies grown on water hyacinth agar showed the most rapid growth possibly due to the presence of the proper nutrients as available from the host plant, and produced the most conidiospores. Colonies grown on cornmeal + V-8 agar produced significantly fewer spores than water hyacinth agar, but showed very slow colony growth, no conidiospores were formed, and many fungal air contaminants were present. V-8 broth was formulated for mass culture of the primary inoculum.
W81-02974

2J. Erosion and Sedimentation

SEDIMENT DEPOSITION IN THE WHITE RIVER RESERVOIR, NORTHWESTERN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
W. G. Batten, and S. M. Hindall.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price: $2.00. Geological Survey Water-Supply Paper 2069, 1980. 30 p, 13 Fig, 3 Tab, 12 Ref, 1 Plate.

Descriptors: Sediment transport, Erosion, Streams, *Sediment yield, *Wisconsin, Reservoirs, *Reservoir silting, Suspended load, Particle size, Sedimentation rates, Bed load, Gaging stations, Data collections, *White River Reservoir, Northwestern Wisconsin.

Sediment transport in the White River and deposition in the White River Reservoir were studied to determine past erosion rates in the red-clay area of northwestern Wisconsin. The original reservoir capacity and volume of deposited sediment were calculated to be 815 acre-feet and 487 acre-feet, respectively. Analyses of deposited sediment averaged 43% sand, 40% silt, and 17% clay. The gross rate of deposition was about 7.0 acre-feet per year over the reservoir history, 1907-76. The rate for the period 1963-76 was 5.7 acre-feet per year based on Cesium-137 dating. Presently, the reservoir traps only sand and some silt-sized sediment. Clay-sized material (over 80% of suspended sediment presently entering the reservoir) pass through without being deposited. Based on limited data, the average annual sediment yield for the 279 square mile drainage area above the reservoir was about 50 tons per square mile or 8 acre-feet per year. Almost all of this sediment is derived from steep unvegetated streambanks in a red-clay area comprising less than 10% of the total drainage area. (USGS)
W81-02912

EFFECTS OF CLIMATIC VARIATION AND LAND USE CHANGES ON SEDIMENT PRODUCTION FROM UPPER BLACK EARTH CREEK, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Geography.
S. J. Cary.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203127, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 104 p, 20 Fig, 5 Tab, 41 Ref. OWRT-A-079-WISC(1).

Descriptors: *Sediment transport, *Sediment yield, Sediments, Seasonal variation, Climatic data, Regression analysis, *Wisconsin, Tractive forces, Trap efficiency, Aquatic soils, Silt, Intermittent streams, Seasonal distribution, Climatology, Weather, Mathematical studies, Storm runoff, Storm water, Storms, Rainfall intensity, Precipitation intensity, *Land use, *Rainfall-runoff relationships, Upper Black Earth Creek watershed.

During 1954-1967, land use in Black Earth Creek underwent changes which caused an increase in soil loss potential. These changes included a substantial loss of woodland and pasture, an increase in cropland, and increased corn planting. Climate was also different for the 1950's and 1960's: the former period experienced frequent flood-producing storms in early summer months (May-July); most potentially flood-producing storms in the 1960's occurred during August-October. Variations in sediment availability (SA) were studied to assess probable impacts of the documented environmental changes for sediment production (SP) in the Upper Creek. Analysis of the monthly sediment transport relationship for the Upper Creek allowed quantification of seasonal and intraseasonal variations of SA in response to precipitation variations. SA (an exponent of a regression equation describing the power functional relationship between sediment yield and water yield) was high in early summer and low at other times. Monthly precipitation negatively associated with SA at all growing season times, except for the early Spring following snowmelt. Hence, relatively high annual SP over 1954-1960 was attributed to large storm occurrence frequency over May-July, while low annual SP over 1961-1965, was due to shift in frequency to late summer. (Zielinski-IPA)
W81-03003

EROSIONAL POTENTIAL OF STREAMS IN URBANIZING AREAS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., J. M. DiLouie, and T. Pytlar, Jr.
Water Resources Bulletin, Vol 17, No 1, p 36-45, February, 1981. 9 Fig, 2 Tab. OWRT-B-067-NJ(3). 14-34-0001-8032.

Descriptors: *Erosion, Bank erosion, Channel erosion, Stream erosion, Erosion control, Geomorphology, Storms, Bank protection, Land management, Stream stabilization, Culverts, Land use, Land classification, *Urbanization, Urban runoff, Sediment transport, Stream degradation.

In urbanizing areas, the usual increase in flood flows also increases erosional capability of streams. In order to evaluate such tendencies quantitatively, 25 stream reaches were studied, and were classified as to whether erosion of the channel and banks was light, medium, or heavy. Analysis of characteristics indicated that (1) densely developed areas are correlated with greater erosion, (2) wide stream buffers of natural vegetation are correlated with lesser erosion, and (3) there is no definite correlation of erosion to slope or characteristics of soil. Erosional stream instability can be avoided by retention of storm water runoff, creating additional channel roughness or reducing channel slope during floods by drop structures, such as culverts, which restrict flow. Channel straightening and general bank protection should be minimized in such streams. Design of culverts should take such effects into consideration. (Whipple-Rutgers)
W81-03011

UNSTEADY SEDIMENT TRANSPORT LAW AND PREDICTION OF AGGRADATION PARAMETERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
J. P. Soni.
Water Resources Research, Vol 17, No 1, p 33-40, February, 1981. 9 Fig, 1 Tab, 15 Ref.

Descriptors: *Model studies, *Sediment transport, *Aggradation, Stream erosion, Deposition(Sediments), Equations, Mathematical studies, Erosion.

This paper develops a general sediment transport law in the form of a differential equation for non-uniform flow conditions, using the equations of motion for water and continuity equations for both sediment and water. Laboratory experiments were performed to study the aggradation when there is a sudden increase in sediment transport rate upstream. Using the law, expressions for predicting the maximum depth of aggradation and length of aggradation have been obtained. Good agreement was obtained with experimental results, model results, and Gessler's numerically obtained parameters. (Cassar-FRC)
W81-03053

MEASUREMENT AND COMPUTATION OF BED-MATERIAL DISCHARGE IN A SHALLOW SAND-BED STREAM, MUDDY CREEK, WYOMING,
Geological Survey, Lakewood, CO.
E. D. Andrews.
Water Resources Research, Vol 17, No 1, p 131-141, February, 1981. 7 Fig, 2 Tab, 22 Ref.

Descriptors: *Bed load, *Streams, *Sediment discharge, Sediment load, Muddy Creek, *Wyoming, Equations, Mathematical studies, Shallow water, Sand-bed stream.

Measured and computed bed-material discharges were compared to determine the most suitable approach for a shallow sand-bed stream. On 35 occasions suspended and bedload sediment dis-

charges were measured in Muddy Creek, Wyoming, under water discharge conditions ranging from 0.15 to 1.57 cu meters per sec. The field results were compared with results using equations by Engelund-Hansen, Yang, Shen-Hung, and Ackers-White. These equations predicted bed-material discharges of between 0.5 and 2 times the observed rates 60-79% of the time. Laboratory flume data under the same flow conditions were very close to measured bed-material discharges. Although the equations are useful when hydraulic conditions and sediment characteristics are similar to those used in formulating the equations, differences in these conditions make field measurements more desirable. (Cassar-FRC)
W81-03060

2L. Estuaries

RELATION BETWEEN FRESHWATER FLOW AND SALINITY DISTRIBUTIONS IN THE ALAFIA RIVER, BULLFROG CREEK, AND HILLSBOROUGH BAY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. F. Giovannelli.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-207680, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-102, 1981. 62 p, 28 Fig, 3 Tab, 53 Ref.

Descriptors: *Salinity, *Streamflow, *Saline-freshwater interfaces, *Estuaries, Water quality, Data collections, Gaging stations, Sampling, Sites, Tides, Specific conductivity, Low flow, Physical properties, Model studies, Mathematical studies, Regression analysis, *Florida, *Hillsborough County, Hillsborough Bay, Alafia River, Bullfrog Creek, Saltwater wedge.

Data on streamflow, tide stage, specific conductance, and chloride concentration were collected in the Alafia River and Bullfrog Creek to describe the salinity and physical characteristics of the saltwater wedge. The location of the saltwater-freshwater interface for both streams was described by multiple regression equations involving streamflow and tide stage. Low-flow frequency data were used with regression relationships to show the effect of withdrawals of freshwater from the Alafia River on the location of the saltwater interface. Examples are presented without storage and with storage and minimum streamflow requirements. In every case, the effect of reductions in streamflow was upstream encroachment of saltwater. Salinity in Hillsborough Bay in the vicinity of the Alafia River and Bullfrog Creek was evaluated using a salt-transport model for various freshwater inflow conditions. Model results indicate that freshwater inflow from these streams has the greatest effect on the salinity of areas closest to the mouth during periods of above average inflow. (USGS)
W81-02994

ALGAL MAT PRODUCTIVITY: COMPARISONS IN A SALT MARSH,
San Diego State Univ., CA. Dept. of Biology.
J. B. Zedler.
Estuaries, Vol 3, No 2, p 122-131, June, 1980. 5 Fig, 2 Tab, 33 Ref.

Descriptors: *Salt marshes, *Algae, *Productivity, Estuaries, Eutrophication, Aquatic plants, Wetlands, Saline water, Saline soils, Aquatic algae, Cyanophyta, Chlorophyta, Diatoms, Arid lands, Primary productivity, Saturated soils, Tijuana Estuary, *California, Temporal distribution.

Algal mats composed of filamentous bluegreen and green algae and diatoms were very productive in a salt marsh in the Tijuana Estuary, southern California. Factors affecting production were light intensity, desiccation, and drainage. Estimated annual net primary productions (grams carbon per sq meter per year) associated with the overstory plants were as follows: Jaumea carnosa (Less.) Gray, 341; Spartina foliosa Trin., 276; Monanthochloe littoralis Engelm, 253, and Batis maritima L., 185. Both light intensity and production were 20% less under the Spartina canopy than under Jaumea. At higher elevations (Monanthochloe site) inundation was less frequent and algal mats did not grow as well. At the Batis site, drainage was poor, soils were supersaturated with water, and salt accumulation was a possible factor in poorer productivity. Seasonal growth patterns were similar at all 4 stations. Productivity was highest in summer, lower in fall, increasing in winter, and dropping again in spring. Production of algae in this arid climate was greater than that reported for sites on the Atlantic Coast because hypersalinity inhibits growth of vascular plants, thus allowing greater light penetration to the algae. (Cassar-FRC)
W81-03194

HYDROGRAPHIC FEATURES OF FORT PIERCE INLET, FLORIDA,
Florida Inst. of Tech., Melbourne.
O. H. Von Zweck, and D. B. Richardson.
Florida Scientist, Vol 43, No 2, p 74-83, Spring, 1980. 9 Fig, 8 Ref.

Descriptors: *Hydrography, *Inlets, *Tidal effects, Tidal currents, Tidal waters, Water circulation, Salinity, Water temperature, *Florida, Estuaries.

Preliminary results and the salient hydrographic features observed during an investigation of the circulation and waters encountered in the Fort Pierce Inlet and Harbor are reported. The present inlet and main ship channel are man-made, the channel being maintained at a depth of 7 m. The inlet exerts a broad influence on the circulation and waters in the lagoon and adjoining coastal area. Salinity, temperature and current data were collected under varying tidal and meteorological conditions at sites throughout the inlet and harbor. The circulation was predominantly tidal driven, with 93% of the variance of the current flow accounted for by tidal constituents. The horizontal and vertical salinity structure of the water was controlled for the most part by the stage of the tide and tidal currents. No large horizontal temperature differences were consistently observed. Taylor Creek water was dark brown because of tannic acid content, Indian River water had a brownish-green tint, and coastal water was bluish-green. The circulation pattern was largely affected by topographical features such as islands, shoals, grass flats, and dredged channels. (Small-FRC)
W81-03201

DISTRIBUTION AND SEASONALITY OF MACROALGAE ON OYSTER COMMUNITIES OF CENTRAL CHESAPEAKE BAY,
Horn Point Environmental Lab., Cambridge, MD.
J. L. Connor.
Botanica Marina, Vol 23, No 11, p 711-717, November, 1980. 2 Fig, 5 Tab, 20 Ref.

Descriptors: *Marine algae, *Benthic flora, *Estuaries, Algae, Benthic fauna, Distribution patterns, Seasonal, *Chesapeake Bay, Oysters, Oyster communities.

The systematics and ecology of the benthic macroalgae associated with subtidal oyster bars in the Maryland Chesapeake Bay were investigated. Chlorophyta were present on oyster bars throughout the year with maximum numbers of species and maximum biomass occurring in spring. The Phaeophyta were represented by a single filamentous species, Ectocarpus intermedius Kutz. Five species of Rhodophyta were frequently present as components of the oyster bar flora. Three additional species of Rhodophyta were occasionally found. It appears that most of the algae collected in subtidal Chesapeake Bay, Maryland reproduce asexually by spores and/or vegetative fragments, but sexual reproduction does occur in some of the red algae. Species distribution depended on both season and location. (Baker-FRC)
W81-03213

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

VERTICAL TUBE FOAM EVAPORATION APPLIED FOR HEAT TRANSFER ENHANCEMENT IN A COMMERCIAL PLANT AND TO VAPOR COMPRESSION DISTILLATION OF SALINE WATER,
California Univ., Berkeley. Coll. of Engineering.
H. H. Sephton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202095, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March, 1981. 43 p, 8 Fig, 13 Tab, 4 Ref. OWRT-C-80134-S(No 8526)(1), 14-34-0001-8526.

Descriptors: *Foam separation, *Desalination plants, *Saline water, *Heat transfer, *Vapor compression distillation, *Evaporators, Water reuse, Industrial plants, Water, Brines, Seawater, Thermal conductivity, Distillation, Vaporization, Experimental design, Evaporation rate, Evaporation control, Evaporation, Water use, Water conservation.

Heat transfer enhancement by vertical tube foam evaporation (VTFE), a novel patented process for seawater/brine evaporation, was developed in the author's laboratory over the past 15 years. The process, also known as interface-enhanced vertical tube evaporation (VTE), relies on imposing foamy evaporative flow of the liquid and its vapor over a heat transfer surface. The VTFE method was applied in a two-part study by converting two pre-existing evaporator facilities for foamy mode operation and testing to compare VTE and VTFE performances. Part One describes conversion of a commercial 4-effect VTE for VTFE operation, and comparative testing with the VTE and VTFE modes with freshwater and seawater feeds. Test data showed an improvement of 40% by operation of this VTE facility in the VTFE mode. Part Two describes conversion of a vapor compression VTFE facility to a mobile facility for field operation, and similar comparative testing. Test data showed that VTFE operation gave a 27% performance improvement over conventional VTE operation and a concurrent 20% reduction in evaporative energy needed. Recommendations for further demonstration work were made to facilitate VTFE acceptance as a commercial process. (Zielinski-IPA)
W81-02903

DEVELOPMENT OF NON-FOULING PIEZOELECTRIC ULTRAFILTRATION MEMBRANES,
Pennwalt Corp., King of Prussia, PA. Central Research and Development Dept.
W. D. Benzinger, M. G. Toal, O. S. Sprout, and G. M. Hinde.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203101, Price codes: A03 in paper copy, A01 in microfiche. Final Report, First Year (Sept. 1979-Aug. 1980). 35 p, 8 Fig, 2 Tab, 11 Ref. OWRT-C-90241-S(No 9421)(1), 14-34-0001-9421.

Descriptors: *Ultrafiltration, *Fouling, Membranes, *Membrane processes, Desalination, *Pretreatment of water, Waste water treatment, Colloids, Iron oxides, Silica, *KYNAR, *Poly(Vinylidene fluoride), *Piezoelectric, Poling.

The goal of this project is to prepare piezoelectric ultrafiltration membranes from KYNAR poly(vinylidene fluoride) and to evaluate the resistance of such membranes to fouling by colloidal materials normally found in saline and brackish water. The techniques commonly used for poling and for measurement of the piezoelectric activity of extruded, oriented poly(vinylidene fluoride) films were found to be either unsuitable or ineffective for membranes. Other methods for measurement of piezoactivity were investigated, and it

appears that determination of the pyroelectric coefficient offers the best chance for detection of piezoactivity in membranes. Modified methods of poling were also investigated, but thus far piezoactivity has not been detected with certainty in any of the 'poled' membranes. A procedure to determine, independently, the flux declines due to compaction and to fouling was developed. Under the test conditions, colloidal ferric hydroxide fouled these membranes rapidly, but colloidal silica did not foul them. No significant difference in rate or extent of fouling has been found between unpoled and 'poled' membranes. A cell was designed and constructed for investigation of the effects of ultrasonic pressure pulses on fouling and cleaning of membranes.
W81-02975

PREPARATION OF ION-EXCHANGE MEMBRANES WITH EXTREMELY LOW AREAL RESISTANCES.
Southern Research Inst. Birmingham, AL.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203135, Price codes: A03 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, July, 1979. 30 p, 1 Fig, 6 Tab. OWRT-C-80025-S(No 8524)(1), 14-34-0001-8524.

Descriptors: *Membranes, *Anion exchange, *Cation exchange, *Water treatment, *Desalination, Water supply, Water reuse, Reclaimed water, Membrane filters, Membrane processes, Ion exchange, Ions, Cations, Anions, Desalination apparatus, Desalination plants, Industrial plants, Design criteria, Saline water, Brines, Seawater, Salinity, Process control, Water quality control.

Methods were developed during this twelve-month program for the preparation of large anion-exchange (AE) membranes having areal resistances of 1.0 ohm-sq. cm or less, and acceptably high transference numbers for counter-ions (0.85 or higher); as well as for the preparation of large cation-exchange (CE) membranes. The best portions of the CE membranes had low resistances (1.0 ohm-sq. cm, or less) and acceptably high transference numbers, but additional work is needed to improve quality control in order to obtain uniform properties within each membrane and from membrane-to-membrane. Although AE membrane uniformity was better than that of CE membranes, some effort for quality control improvement is also recommended. Information on service lifetimes of these membranes was not developed. A study to determine any decline in properties of these experimental membranes during long-term desalination tests and to intercompare such results with the decline of properties of commercial membranes under the same test conditions, is recommended. In addition, optimum times, temperatures, and other process conditions for use in large-scale production of these experimental membranes need assessment. (Zielinski-IPA)
W81-03004

SOLAR DESALINATION SYSTEM,
W. A. Rhodes.
U.S. Patent No 4,210,494, 5 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 222, July 1, 1980.

Descriptors: *Patents, *Desalination, *Desalination processes, *Water treatment, Water purification, Separation techniques, Solar radiation, Distillation, *Solar distillation, Condensation equipment.

A solar desalination system comprises a tank having a transparent cover. Salt water to be distilled is introduced into the tank at an inlet spaced from the cover while brackish or waste water is withdrawn from the tank through an outlet at substantially the same level as the inlet. A closed circuit air loop includes a tubular sparger of porous material which extends along the tank bottom in slightly spaced relation. Air under pressure is delivered to the sparger at one end by a conduit passing through the end wall of the tank and a pump. Moisture-free air is introduced into the pump by a tube extending from a condenser. Vapor-saturated air is exhausted from the tank at a level between the water surface and the cover and is conveyed to the condenser through a pipe. Distilled water is taken from the bottom of the condenser. In a modified embodiment, the compressor is bypassed by a duct extending from the tube to the conduit and includes an adjustable value. In operation, air from the sparger passes upwardly through the water in the tank in the form of small bubbles which entrain moisture to the point of saturation. The water and vapor-saturated air is heated by solar rays passing through the transparent cover. (Sinha-OEIS)
W81-03029

3B. Water Yield Improvement

RESTORING WELLS IS NO GAMBLE IN LAS VEGAS,
B. P. Varhol.
Johnson Drillers Journal, Vol 52, No 6, p 5-7, November/December, 1980. 3 Fig.

Descriptors: *Water wells, *Rehabilitation, *Water yield improvement, Las Vegas, Nevada, Wells, Acids, Sulfamic acid, Drawdown, Calcium compounds, Magnesium compounds, Iron compounds, Well screens, Clogging.

The Las Vegas (Nevada) Valley Water District has been restoring wells incrusted with calcium, magnesium and iron compounds. Sulfamic acid solution, 10% in water, was used to dissolve the mineral deposits at the rate of 3/4 pound solid acid per gallon of water in the casing. During the next 24 hours, the well was surged 10 times every 4 hours to break up loose incrustant and push fresher acid into the formation. After a 24 hour soak, the well was pumped to waste and 300 lb tetrasodium pyrophosphate added for dispersal of silt and by-products of the acid treatment. The 5 rehabilitated wells showed improvement in capacities from 45 to 160%. The District saved $16,000 in pumping costs annually. Payback time for this project was 1 and 1/2 years. (Cassar-FRC)
W81-03230

3C. Use Of Water Of Impaired Quality

SALINITY AND PRODUCTION OF FOOD CROPS: A PROBLEM FROM ANTIQUITY, A CHALLENGE FOR THE FUTURE,
Delaware Univ., Newark. School of Life and Health Sciences.
G. F. Somers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203150, Price codes: A03 in paper copy, A01 in microfiche. Second University of Delaware College of Arts and Science Distinguished Faculty Lecture, May, 1980. 29 p, 6 Fig, 50 Ref. OWRT-A-048-DEL(1).

Descriptors: *Salinity, *Saline-freshwater interfaces, *Crop production, *Impaired water use, Cropland, Plant growth, *Salt tolerance, Saline water systems, Saline water, Saline soils, Sea water, Salinity currents, Crop yield, Agricultural engineering, Farms, Farming, Agriculture, Foods, Food chains, Grazing, Plant populations, Salt rejection.

The question was earlier asked (Somers, 1975): 'are there seed-bearing halophytes that can be grown using water approaching, or equal in salinity to, that of the oceans and that could be used for food sources, including protein, for man and domesticated animals, or that could be modified by selection and breeding to serve such use.' Criteria for potential crop study were identified, including: natural growth in saline habitats, abundant seed production and sufficient seed size, and potential for good food attributes and adaptation to agricultural production. Several species were identified that merit further evaluation. Seashore mallow (Kosteletzkya virginica), a tidemarsh native of southwestern United States is among the most promising, readily satisfying the identified criteria. Smooth cordgrass (Spartina alterniflora) of the same geographical area might prove useful as a forage crop for cattle grazing, being 7-15% protein. Selective exclusion of ions, selective excretion, and succulence are three potential adaptations to salt tolerance at the plant tissue level. Technological concerns include seed storage, land preparation and management, harvesting, desalinization of harvested material if needed, palatability, and nutritive value. Cultural concerns were also considered. (Zielinski-IPA)
W81-03006

PREDICTION OF SONGBIRD RESPONSES TO HABITAT ALTERATION RESULTING FROM WASTE WATER IRRIGATION,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 5C.
W81-03007

WATER REUSE: PROJECTING MARKETS AND COSTS,
Orange-Los Angeles Counties, CA. Water Reuse Study.
F. W. Horne, R. L. Anderton, and F. A. Grant.
Journal of the American Water Works Association, Vol 73, No 2, p 66-75, February, 1981. 5 Fig, 7 Tab.

Descriptors: *Water reuse, *Water management(Applied), Reclamation, Cost-benefit ratio, Recirculated water, Reclaimed water, Water conservation, Water demand, Los Angeles, Orange County, *California, Water supply development, *Waste water treatment.

The aspect of water reuse as viewed in Los Angeles and Orange counties in southern California is discussed. Perhaps no other area in the United States is as far removed from its sources of water supply as these counties. Current water reuse projects in these areas total 200,000 cubic meters/day, and include such applications as park, golf course, freeway and horticultural irrigation, residential lawn watering, power plant cooling, paper manufacturing, soil compaction and dust control, street cleaning, groundwater replenishment and seawater intrusion control. The long-term reuse potential for the region is 1150 ML/d. The basic water reclamation process used in the study area is activated sludge secondary treatment, followed by dual media filtration and chlorine disinfection. Current procedures consistently detect viruses in unchlorinated secondary effluents, usually in the range of 0.1-10 PFU/gal. However, in 120 plant scale samplings to date, at sample volumes of 1100-1900 L each, no positive virus results have been detected in either system B or C effluents. The B-level process calls for direct filtration; the C-level for lime softening. A D-level process of carbon filters and reverse osmosis provides a means for groundwater recharge applications such as water table replenishment and seawater intrusiion control. (Baker-FRC)
W81-03072

WATER LAW - REFUSING IRRIGATION WASTE WATER ON DIFFERENT LANDS: A WARNING TO GET A NEW PERMIT,
For primary bibliographic entry see Field 6E.
W81-03102

UNDERGROUND TRAVEL OF RENOVATED WASTE WATER,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
R. C. Rice, and P. Raats.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 106, No EE6, p 1079-1098, December, 1980. 15 Fig, 2 Tab, 9 Ref.

Descriptors: *Reclaimed water, *Groundwater movement, *Infiltration, *Groundwater pollution, Waste water treatment, Aquifer management, Nitrates, *Water spreading, Groundwater recharge, Artificial recharge.

Equations are presented to predict the minimum underground detention time for groundwater recharge facilities utilized in land application of

sewage effluents. Shallow aquifers in which the reclaimed water is collected in drains were analyzed using horizontal flow theory. Flow nets were used to determine the detention time for deep aquifers. The nitrate peak associated with newly infiltrated waste water in deep aquifers would be considerably flattened by the time the renovated water would be collected for reuse by wells. It would not be practical to separate the portion of renovated water that has a high nitrate content either for further treatment or for recycling through the land use system. The flow system analysis of shallow aquifers determined that more than 60% of the nitrate could be recovered in 25% of the renovated water when the infiltration rate was greater than 1 ft/day. (Small-FRC)
W81-03113

STORMWATER AND RECLAIMED EFFLUENT IN TRICKLE IRRIGATION,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Inst. for Desert Research.
G. Oron, G. Shelef, and B. Zur.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 106, No IR4, p 299-310, December, 1980. 9 Fig, 2 Tab, 15 Ref.

Descriptors: *Trickle irrigation, *Reclaimed water, *Storm water, Filtration, Reservoir releases, Agriculture, Irrigation, *Israel, Suspended solids, Impaired water use.

Experiments with trickle irrigation using two mixtures of reservoir effluents and stormwater were conducted at two communal farms in the Jezreel Israel. The purpose of the study was to encourage the use of marginal water in agriculture and to increase productivity. Ring-type filters gave slightly better COD removal, while the most efficient removal of total suspended solids was with nonautomatic filters with 80 mesh. Filters with a higher mesh tended to clog, but self-flushing automatic filters at the head of the irrigation system worked efficiently. There were no changes in the discharge of pollutants, but this should be monitored. Pumping locations in the reservoirs were compared; a floating inlet 0.3 to 0.5 m below the surface was found best. Although a higher algae concentration may be found in the upper layers of the effluent, most of the nondegraded and other suspended matter settles or floats in the lower layers. (Small-FRC)
W81-03123

COMMENT ON 'AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL' BY N. BURAS AND P. DARR,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
D. H. Marks.
Water Resources Research, Vol 17, No 1, p 253, 254, February, 1981.

Descriptors: *Planning, *Optimization, Costs, Operations research, *Israel, Economies of scale, Waste water treatment, *Impaired water use.

The Buras and Darr (1979) paper on use of marginal water in Israel employs nonlinear rather than linear functions for technology and transportation costs, which are concave functions. The author of this comment states that the separable programing used with this model guarantees local, not global, optima. Mr. Darr replies that the model was used in a practical application and was shown to be accurate for framework water resources planning. The solution of this problem, concerning the mix of marginal waters with fresh waters, was not obvious at the beginning of the study, but proved sound from an engineering point of view. (Cassar-FRC)
W81-03149

CHARACTERIZATION AND AGRICULTURAL UTILIZATION OF SWINE WASTE LAGOON EFFLUENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
R. G. Wilhelm, D. D. Martens, D. L. Hallock, E. R. Collins, Jr., and E. T. Kornegay.
Water, Air, and Soil Pollution, Vol 14, p 443-450, 1980. 6 Tab, 21 Ref.

Descriptors: *Farm wastes, *Farm lagoons, *Nutrients, *Fertilizers, *Hogs, *Impaired water use, Agriculture, Ultimate disposal, Waste disposal, Nitrates, Nitrogen compounds, Phosphorus compounds, Corn.

The suitability of applying swine waste lagoon effluent to agricultural crops was studied. Elemental concentrations in 4 lagoons varied widely, affected by evaporation, dilution, management practices, and biological reactions. Maximum and minimum concentrations of K were 47-618 ppm; P, 15-318 ppm; and N, 74-1508 ppm. Corn grain yields in kg per ha were as follows: control, 4940; chemical fertilizer, 5540. Primary lagoon effluents applied at the rates of 3.2, 6.4, 11.4 and 21.6 ha-cm produced yields of 7880, 8270, 7710, and 7050 kg per ha respectively. Secondary lagoon effluents applied at the rates of 11.4 and 21.6 ha-cm yielded 6320 and 7070 kg per ha respectively. Increases in corn yield were attributed to correction of N deficiency and alleviation of moisture stress. (Cassar-FRC)
W81-03208

3D. Conservation In Domestic and Municipal Use

ALASKA VILLAGE DEMONSTRATION PROJECTS, FINAL REPORT,
Corvallis Environmental Research Lab., OR. Freshwater Div.
For primary bibliographic entry see Field 5D.
W81-02944

DENVER'S ECH2ONERGY PROGRAM: A BOON TO HOMEBUYERS, A BOOST FOR HOUSING,
Denver Water Dept. CO.
W. H. Miller.
Journal of the American Water Works Association, Vol 73, No 2, p 82-85, February, 1981.

Descriptors: *Water conservation, *Water management, *Construction, Construction costs, Costs, Conservation, Economics aspects, Water demand, Water distribution(Applied), Water supply, Water yield improvement, *Denver, Colorado.

The ECH2ONERGY house project carried out in Denver by the Homebuilders Association of Metropolitan Denver, the Public Service Company of Colorado and the Denver Water Department is described. The project involved the construction of a house using energy- and water-saving techniques. The house was open to the public with exhibits and information as to how these saving measures could in some cases be put into already existing structures. Use of the water and energy savings techniques described would free up additional capital to the home investor, raising the income level of the buyer and thus helping him to qualify for a home purchase. By decreasing the burden on the home buyers, such homes also increase the activity in the building field. The overall program not only encourages water and energy savings but also allows financial credits on home loan applications for the dollar savings that accrue from these savings. (Baker-FRC)
W81-03073

3E. Conservation In Industry

REDUCING WASTE WATER FROM CUCUMBER PICKLING PROCESS BY CONTROLLED CULTURE FERMENTATION,
North Carolina Univ. at Chapel Hill.
L. W. Little, J. G. Wendle, J. Davis, R. M. Harrison, and S. J. Dunn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169543, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-046, February, 1980. 101 p, 17 Fig, 22 Tab, 18 Ref, 1 Append. S-804220.

Descriptors: *Industrial waste water, *Waste water composition, *Waste water treatment, *Food-processing wastes, *Water conservation, Recycling, Fermentation, Brines, Waste recovery, Water demand, Cucumber pickling process.

The controlled culture fermentation (CCF) process was compared with the conventional natural fermentation (NF) process on a demonstration scale in regard to product quality and yield, volume and concentration of waste waters. The weight of cucumbers, volume of water, and amounts of additives were recorded; pH, acidity, salinity, and temperature were monitored, and after brining the brinestock quality was evaluated. The brinestock was processed and the spent brines and processing waters were collected. The volume and salinity, BOD, nitrogen, phosphorus, and residues were determined. The spent brine from the CCF process had lower total dissolved solids. The pH was low enough to make recycling impossible without treatment to raise the pH to near neutral. The CCF process produces pickles of equal quality to the NF process, but has the following advantages over it: reduction of salt requirements; less salt to be discharged to waste; more rapid and consistent fermentation, lower volume of processing water for a given desalting time; consistent production of high quality brinestock; and less loss of brinestock due to bloater formation. (Brambley-SRC)
W81-02949

3F. Conservation In Agriculture

REDUCING DROUGHT EFFECTS ON CROPLANDS IN THE WEST-CENTRAL GREAT PLAINS,
Science and Education Administration, Akron, CO. Central Great Plains Research Station.
B. W. Greb.
Available from Supt. of Documents, GPO, Washington, DC 20402. Stock No 001-000-03978-4. Agriculture Information Bulletin No 420, June, 1979. 31 p, 13 Fig, 14 Tab, 65 Ref.

Descriptors: *Drought, *Water conservation, *Farm management, *Soil water, *Irrigation practices, Agricultural runoff, Crop production, Drought resistance, Dry farming, Cropland, Fallowing, Soil-water-plant relationships, Snow management, Water use efficiency, Erosion control, Wind erosion, Great Plains.

The drought of 1977 in much of the Midwest and Western United States called attention to the need for improved management of limited water resources. Water conservation concepts and practices for use on dry cropland with some interpretation on irrigated cropland are given for the west-central Great Plains. Strategies for improved water intake efficiency include systems to upgrade the quality of summer fallow, snow control, reducing runoff water, irrigation, and deep plowing. Water use by crops can be improved through soil fertility, better plant stock, matching plant populations with water supply, cultural manipulations, and improved timing of irrigation. Wind and water erosion - brought about by prolonged drought - and their control are briefly outlined. Results show significant progress of many facets of water management at the research level, some of which have been transferred into commercial farming channels. The transfer of established and new water conservation concepts and practices for cropland will likely be faster and with greater diversity than in the past because of energy and economic pressures. (Moore-SRC)
W81-02964

ROTARY IRRIGATION SYSTEM,
J. M. Hait.
U.S. Patent No 4,209,035, 13 p, 12 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1275, June 24, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, Application equipment, Irrigation

practices, Irrigation efficiency, Irrigation operation and maintenance.

A rotary irrigation system moves continuously across relatively large areas of land while the areas are being sprinkled. One end of a relatively long length of horizontal tubing is pivotally mounted to a vertical pipe containing water under pressure and the other end of the tubing is connected to a power mover. The tubing is provided with sprinkling heads spaced throughout its length and is supported above the ground by carriages so that the tubing can be used to irrigate an area of ground which is not completely flat. Each of the carriages is supported by a single wheel. A cable connected between the vertical pipe and the front end of the power mover causes the power mover to travel in a circle around the vertical pipe with the power mover providing an outward tension on both the cable and the tubing. (Sinha-OEIS)
W81-03015

COMPUTER-CONTROLLED IRRIGATION SYSTEM,
Motorola, Inc., Schaumburg, IL. (Assignee).
S. Barash, Y. Brandman, Y. Cohen, S. Shporn, and J. Vishnipolsky.
U.S. Patent, No 4,209,131, 17 p, 12 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1308, June 24, 1980.

Descriptors: *Patents, *Irrigation systems, *Control systems, *Automation, Computer programs, Irrigation efficiency, Water delivery, Rates of application, Environmental control.

An irrigation system for automatically irrigating an agricultural area having a number of fields for producing various crops includes a central station and remote stations located in the fields. A computer with associated peripherals in the central station is loaded with an irrigation program defining a predetermined schedule for delivery of preestablished quantities of water to each field. The delivery of water can further be dependent on environmental conditions such as wind speed, temperature, humidity, and other factors. The computer via a communication path, such as a radio channel or three-wire circuit, sends coded command messages to selected remote stations for activating valves and pumps for delivering the preestablished quantities of water to the respective fields and continuously interrogates the remote stations for flow meter, water-pressure meter, environmental conditions and alarm information to diagnose proper operation and to monitor the delivery of water. The irrigation system can equally well control solid-set, pivot sprinklers, or any other suitable sprinkler systems. (Sinha-OEIS)
W81-03016

DRIP LEVEL IRRIGATION EMITTER UNIT,
R. Mehoudar.
U.S. Patent No 4,209,133, 7 p, 6 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1309, June 24, 1980.

Descriptors: *Patents, *Irrigation, *Flow control, Application equipment, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance, *Drip irrigation.

Drip level irrigation emitter units include flow restricting means so that water, constrained to pass through, has its flow pressure reduced from an initial supply flow pressure to a lower emission flow pressure. It is the object of this invention to provide a drip level irrigation emitter unit with a control mechanism where variations of the output emission rate of the device with variations of the input supply pressure are reduced to a minimum. There is provided an emitter unit having flow restricting means, a control mechanism, inlet and outlet control chambers, and a resiliently flexible membrane sealingly separating the control chambers. The resiliently flexible membrane and its location between the two chambers ensures that the liquid pressure in the outlet chamber is always a predetermined fixed amount less than that in the inlet chamber. In this way pressure control is only exercised once the pressure differential has been established. (Sinha-OEIS)
W81-03017

METHOD OF WATERING,
L. G. Hermelin.
U.S. Patent No 4,210,282, 8 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 152, July 1, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Movement, Irrigation efficiency, Fluid mechanics.

A watering apparatus comprises a pressure vessel and a spray device to which water is supplied through a hose. The pressure vessel intermittently discharges the water which causes the watering apparatus to move along a given path while utilizing the energy stored in the water. The number of drive pulses per unit of time to a drive means associated with the watering apparatus is preferably determined by the number of pulses delivered per unit of time from the pressure vessel. The drive pulses may be supplied to the drive means simultaneously as the pressure vessel is supplied with water after delivering a pulse, to increase the pressure in the vessel. The watering apparatus is caused to move reciprocatingly along a path having two ends, the direction of drive being switched at the ends of the path. (Sinha-OEIS)
W81-03027

DRIP IRRIGATION SYSTEM,
Hydro-Plan Engineering Ltd., Tel Aviv (Israel). (Assignee).
R. Mehoudar.
U.S. Patent No 4,210,287, 10 p, 8 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 154, July 1, 1980.

Descriptors: *Patents, *Irrigation systems, Irrigation practices, Irrigation efficiency, Application equipment, *Drip irrigation.

A drip irrigation system is provided comprising a thin walled thermoplastic conduit. It is formed integrally with an axially directed wall portion of increased thickness, outlet apertures formed in the wall portion in an axially spaced relationship. Discrete substantially flat emitter units, respectively heat welded to axially spaced apart locations on an inner surface of the wall portion comprises a body member of a substantially rigid thermoplastic material which is heat sealable with respect to the conduit. The emitter units are provided with an elastomeric membrane exposed to the throughflow pressure in the conduit for the purpose of stabilizing the output rate of each emitter unit vis-a-vis possible flow pressure variations in the conduit. (Sinha-OEIS)
W81-03028

OPTIMAL DESIGN AND OPERATION OF PERMANENT IRRIGATION SYSTEMS,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Inst. for Desert Research.
G. Oron, and W. R. Walker.
Water Resources Research, Vol 17, No 1, p 11-17, February, 1981. 10 Fig, 2 Tab, 15 Ref.

Descriptors: *Irrigation efficiency, *Pressure head, *Optimization, Costs, Efficiencies, Irrigation design, Water delivery, Mathematical studies, Economics, Consumptive use, Agriculture, Sprinkler irrigation, Conveyance structures, Pipes, Water conveyance.

Permanent, solid-set pressurized irrigation systems were studied with optimization procedures using the following factors: field geometry, the effect of the pressure head, consumptive use rates, a smaller flow rate in the pipe system, and outlet (sprinkler or emitter) discharge. The irrigation system was divided into subunits to select energy, piping, and equipment costs at the minimum cost point. An analysis of a number of fields with varying dimensions showed that the system cost per unit area increases as total area increases. The most economical shape of the field is nearly a square. Increases in pressure head and sprinkler discharge significantly increase cost, implying that trickle irrigation may be most economical. In most cases the optimal number of subunits was 6 or greater. (Cassar-FRC)
W81-03052

PHYSICALLY BASED PROBABILISTIC MODELS OF INFILTRATION, SOIL MOISTURE, AND ACTUAL EVAPOTRANSPIRATION,
Simon Bolivar Univ., Caracas (Venezuela).
For primary bibliographic entry see Field 2G.
W81-03059

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PREIMPOUNDMENT WATER QUALITY OF THE WILD RICE RIVER, NORMAN COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 5C.
W81-02931

HYDROLOGIC AND LAND-COVER FEATURES OF THE LOXAHATCHEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-03000

RANGE ANALYSIS OF EXCHANGEABLE NORMAL VARIABLES,
Asian Inst. of Tech., Bangkok (Thailand).
H. N. Phien, and A. Arbhabhirama.
Water Resources Research, Vol 17, No 1, p 233-237, February, 1981. 8 Ref.

Descriptors: *Reservoir storage, *Water storage, *Range analysis, Equations, Mathematical studies, *Reservoir capacity.

Range analysis has been used in the investigation of water storage problems. Based on the cumulative nature of the elements of a time series (the cumulative or partial sums of the net inputs), range analysis is used to determine the properties of the related random variables. For example, starting with a reservoir of infinite capacity and exploring the results of various inflows and drafts, the extreme levels define the smallest size a reservoir could have and remain an infinite capacity reservoir. This paper attempts to provide general equations relating the first four moments of the surplus and deficit to the first four moments of the partial sums. Equations relating the expected values of the range, the products of the range, surplus, and deficit, to the partial sum over a given period are also derived. The equations are applied to the case of exchangeable normal variables. (Cassar-FRC)
W81-03067

COMMENTS TO THE U.S. ARMY CORPS OF ENGINEERS REGARDING PROPOSED REGULATIONS ON IMPLEMENTING SECTION 404 OF THE CLEAN WATER ACT: A POSITION OF THE SOCIETY OF AMERICAN FORESTERS.
Journal of Forestry, Vol 79, No 2, p 115-117, February, 1981.

Descriptors: *Forestry, *Water control, *Legal aspects, Drainage, Forest management, Forest soils, Forests, Drainage, Society of American Foresters.

This article states the position of the Society of American Foresters concerning the proposed regulations on implementing Section 404 of the Clean

Water Act and is addressed to the US Army Corps of Engineers. Two portions of the minor drainage definition continue to provide unnecessary difficulties for normal silviculture operations. The first is section 323,4(a)(1)(C)(1)(iv) which, while recognizing an important need for forest management in many parts of the country, places a one year limitation on the exception, which lessens its usefulness. The second section, 323.4(a)(1)(c)(2), states that exempted minor drainage does not include drainage associated with the immediate or gradual conversion of a wetland to a non-wetland. Included as an example is conversion of a wetland species to upland species not typically adapted to life in saturated soil conditions. This could be interpreted to void the exemption for any drainage associated with wetland timber species conversion, irrespective of the hydrological and environmental impacts. A question is also presented regarding section 323.4(a)(6), which deals with best management practices for forest roads. (Baker-FRC)
W81-03134

4B. Groundwater Management

POTENTIAL EFFECTS OF INCREASED GROUNDWATER PUMPAGE ON BARKA SLOUGH, SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. J. Mallory.
Geological Survey Water-Resources Investigations 80-95, December, 1980. 16 p, 8 Fig, 6 Ref.

Descriptors: *Groundwater management, *Water supply, Water resources development, *Aquifer characteristics, Wells, Irrigation, Pumping, *Drawdown, Wetlands, Forecasting, *California, South Barbara County, San Antonio Creek valley, Barka Slough.

Groundwater use in San Antonio Creek valley, Calif., is expected to increase significantly as result of a planned extensive agricultural development in the basin. This additional pumpage may cause significant stress on the groundwater system, particularly on the environmentally sensitive Barka Slough. Expectations of the developer are that about 6,640 acre-feet per year of consumptive groundwater use will be required to irrigate 2,500 acres of vineyards and 1,200 acres of truck-farmed vegetables. This represents an increase in net basin pumpage of about 60%. The developer plans to obtain this water from 12 large-diameter irrigation wells in the Harris Canyon area. Analysis of the potential drawdowns in the vicinity of Barka Slough, by using the Theis nonequilibrium formula, indicates that drawdowns would average 6 feet after 10 years of pumping and would eventually exceed 10 feet. Because the artesian head in the aquifer that supplies the slough is generally less than 3 feet above land surface, these declines would probably mean that the wetlands of Barka Slough would disappear. The effects of this particular agricultural development would be in addition to any decline caused by other increases in pumpage in the basin. (USGS)
W81-02915

UNDERGROUND TRAVEL OF RENOVATED WASTE WATER,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3C.
W81-03113

THE CASE FOR REGIONAL GROUNDWATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W81-03132

GROUNDWATER RESOURCES MANAGEMENT,
Department of Environmental Quality Engineering, Boston, MA. Div. of Water Supply.
R. A. McCraken.
Journal of the New England Water Works Association, Vol 94, No 4, p 275-280, 1980. 1 Ref.

Descriptors: *Groundwater management, *Groundwater contamination, *Hazardous materials, Waste disposal, Regulations, Water quality, Water pollution sources, *New England.

Specific objectives of the waterworks industry are discussed, and the application of management by objectives to ground water resources management is considered. The basic goal of the industry is to provide adequate supplies of safe drinking water. One major problem in realizing this objective in Massachusetts today is the contamination of groundwater by the improper disposal of hazardous material. Measurable amounts of manmade organic pollutants are now able to be detected rapidly in groundwater supplies. When pollutants are found, the water supplier is notified, and an alternative source of water or additional treatment of the water becomes necessary. The assessment of damages, recovery of costs, and providing for the disposal of the waste are problems to be handled by management personnel. It is suggested that the New England Water Works Association go on public record as calling for legislation by the New England states which establishes procedures, regulations, and sites to control and provide for the proper disposal of hazardous wastes. (Small-FRC)
W81-03220

4C. Effects On Water Of Man's Non-Water Activities

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1978,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02977

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1978,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-02978

HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS, METROPOLITAN AREA, 1978,
Geological Survey, Fort Worth, TX. Water Resources Div.
For primary bibliographic entry see Field 2E.
W81-02980

CALIBRATION AND SENSITIVITY ANALYSIS OF THE STORM CONTINUOUS FLOW SIMULATION MODEL (IN FRENCH),
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2A.
W81-03010

EROSIONAL POTENTIAL OF STREAMS IN URBANIZING AREAS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 2J.
W81-03011

4D. Watershed Protection

AN ECONOMIC ANALYSIS STRATEGY FOR MANAGEMENT OF SHORELINE EROSION,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
W. R. Kerns, R. J. Byrne, and C. H. Hobbs.
Coastal Zone Management Journal, Vol 8, No 2, p 165-184, 1980. 6 Tab, 7 Ref.

Descriptors: *Erosion control, *Beach erosion, Land management, Economics, *Model studies, Littoral, Shores, Tidal effects, Costs, *Virginia, Property values, Coasts.

A model is described for incorporating accurate measurements of the impact of erosion control measures on shoreland property and improvements into a decision making framework. Coefficients were provided for calculating erosion-induced losses to property and dwellings. For each square foot of soil lost to erosion, lots containing a dwelling decreased in value by an average of $0.24. When erosion caused loss of distance between the shoreline and a dwelling, the value of the dwelling decreased by an average of $8.64 per foot lost. The model was applied to three case studies in the Virginia coastal area. The data generated by the model could be used in comparing the benefits and costs of selected erosion control measures. The model also provided a basis for comparison between various levels of control and the distribution of the costs of erosion control among property owners and the public and private sectors. (Geiger-FRC)
W81-03117

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

COST EFFECTIVE STREAM AND EFFLUENT MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
D. D. Adrian, C. E. Willis, C. E. Carver, J. W. Male, and C. C. Clarkson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202210, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Center, University of Massachusetts, Publication No 118, Sept. 1980. 103 p, 25 Fig, 10 Tab, 64 Ref. OWRT-B-059-MASS(3), 14-34-0001-7162.

Descriptors: *Water quality control, *Monitoring, *Effluents, Streamflow, *Water sampling, Statistical methods, Regression analysis, Cost-benefit analysis, *Connecticut River, Massachusetts.

The location of sampling stations is a critical factor in the design of a water quality monitoring network in a river basin. There are three levels of design criteria associated with sampling station location. They are: the macrolocation--river reaches which will be sampled within the river basin, the microlocation--station location relative to outfalls or other unique features within a river reach, and representative locations--points in the river's cross section from which grab samples will provide a lateral profile of the stream. This report addresses the determination of macrolocations and representative locations. In addition, economic aspects of monitoring are considered so that the costs and benefits associated with a monitoring design can be used to determine the optimal level of monitoring. The procedure is applied to the Massachusetts section of the Connecticut River Basin. The benefits resulting from water quality monitoring depend upon the reliability of the monitoring. The reliability in turn depends on factors such as sampling frequency and station location, among others. Multiple regression analyses were performed, using streamflow data, to observe how the reliability of monitoring data varies with location and frequency. A procedure using Bayesian analysis is developed to determine the value of water quality monitoring.
W81-02901

A LIMNOLOGICAL COMPILATION OF WATER QUALITY OF THE MINNESOTA RIVER WATERSHED, IN MINNESOTA,
Mankato State Univ., MN. Dept. of Biological Sciences.
T. Feind, D. Braaten, and H. W. Quade.

Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202087, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Minneapolis, Bulletin 107, February, 1981. 49 p, 1 Fig, 45 Tab. OWRT-A-040-MINN(8).

Descriptors: *Limnology, *Water quality, *Minnesota, *Data collections, *Data interpretation, *Data storage and retrieval, Rivers, Hydrologic data collections, Experimental data, Synoptic analysis, Data acquisition, Impaired water quality, Statistical analysis, Mathematical studies, Statistical methods, Statistics, Watersheds, Watershed management, Large watersheds, Computers, *Minnesota River watershed.

This project sought to compile stored water quality monitoring data for the Minnesota River system in a format useful for interpretation of relationships of changes in biota, sources, land use, soils and geomorphology, to water quality. Original data for all Minnesota Pollution Control Agency water quality monitoring stations in the Minnesota River watershed were obtained from volumes 1-8 of the Division of Water Quality, Section of Surface and Groundwaters (1957-1975), and analyzed by month for determination of means, standard deviations, variances, and high, low, and median values. T-tests were used to compare means inferentially. The data are presented by quarterly results only. The results are prefaced by an inventory of each of the 23 stations used, relative to the years of data available for each of 44 parameters measured. Storet parameter retrieval numbers are given for each parameter. Following the inventory (8 tables) are 37 tables of quarterly (seasonal) means arranged from upstream to downstream to allow visual limnological interpretation. Results of T-tests of selected pairs of monitoring stations are given for comparing means of locations related geographically/hydrologically, and for overall comparisons of upper/lower reaches of the Minnesota River. (Zielinski-IPA)
W81-02904

ALKALINE PHOSPHATASE ACTIVITY AND ALGAL SURPLUS PHOSPHORUS AS PHOSPHORUS-DEFICIENCY INDICATORS IN LAKE ERKEN,
Institute of Limnology, Norrtalje (Sweden).
K. Pettersson.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 54-87, June, 1980. 15 Fig, 5 Tab, 50 Ref.

Descriptors: *Phytoplankton, *Phosphorus compounds, *Nitrogen compounds, Nutrients, *Algae, Bioindicators, Lake Erken, *Sweden, Lakes, Limnology, Aquatic algae.

Nutrient conditions for phytoplankton in the moderately eutrophic Lake Erken, Sweden, were studied in 1975-1978. Alkaline phosphatase activity and surplus phosphorus were tested as indicators of phosphorus deficiency. During phosphorus limitation in May-June, the specific alkaline phosphatase activity increased 10 fold. Surplus phosphorus decreased 4-5 fold, also indicating phosphorus deficiency. The Michaelis constant of the alkaline phosphatases reached a minimum at the same time as maximum specific activity, showing phytoplankton adaptation to use of phosphomonoesters as a phosphorus source. N:P ratio of inorganic nutrients changed from greater than 1,200:1 in April to 8:1 in the fall. (Cassar-FRC)
W81-02908

DEVELOPMENT OF A CHEMICAL TOXICITY ASSAY FOR PULP MILL EFFLUENTS,
British Columbia Research Council, Vancouver.
J. M. Leach, and L. T. K. Chung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-126369, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-80-206, February, 1981. 5 p, 1 Fig, 2 Tab.

Descriptors: *Pulp wastes, *Toxicity, Assay, Chemical analysis, *Water pollution, Industrial wastes, Pulp and paper industry, Bleaching wastes, Water pollution control, Waste water treatment, Biological waste water treatment, Secondary waste water treatment, *Fish pollution, Oregon, New Hampshire, Maine, Rivers.

A chemical analysis procedure was developed to rapidly measure compounds responsible for the toxicity of pulp mill effluents to fish. The analytical procedure involved adsorption of toxic compounds from effluent onto Amberlite XAD-2 polymeric resin, elution of adsorbed constituents from the resin with ether and methanol, methylation of the extract, and quantitative analysis by glass capillary column gas chromatography. Results for 113 samples of raw and biologically-treated bleached and unbleached kraft, sulfite and groundwood effluents were converted via toxic units into estimates of acute lethal toxicity. Agreement between 96-h median lethal concentrations calculated by this method and values from bioassays of the effluents using rainbow trout was within + or - 30% for 73% of the samples examined. Calculated 96-h median lethal concentrations and those measured by bioassay differed by more than 30% for the other 27% of samples examined. At present, therefore, toxicity determined from chemical analysis can be a valuable supplement to, but not a substitute for, direct measurement by bioassay. Samples were collected and analyzed for five consecutive days from all pulp mills on the Willamette River, Oregon, and the Androscoggin River flowing through New Hampshire and Maine, to determine loadings of known toxic compounds into and out of the biobasins. Biotreatment at most of the mills was very effective in removing toxicants. Estimates based on theoretical dilution capacity of the receiving waters showed that secondary treatment was highly beneficial in protecting the rivers against the toxic effects of pulp mill effluents. (Moore-SRC)
W81-02941

THE DEVELOPMENT OF AN AQUEOUS TRACE ORGANIC STANDARD REFERENCE MATERIAL FOR ENERGY RELATED APPLICATIONS: INVESTIGATION OF THE AQUEOUS SOLUBILITY BEHAVOIR OF POLYCYCLIC AROMATIC HYDROCARBONS,
National Bureau of Standards, Washington, DC. National Measurement Lab.
W. E. May.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169352, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/7-80-031, February, 1980. 85 p, 20 Fig, 34 Tab, 52 Ref, 2 Append. EPA-IAG-D5-E684.

Descriptors: *Aromatic compounds, *Effluents, *Hydrocarbons, *Solubility, Physical properties, Chromatography, Pollutants, Sediments, Standard reference.

The development of a Standard Reference Material (SRM) for aqueous solutions of polynuclear aromatic hydrocarbons (PAH) in a water matrix is necessary to provide data quality assurance in the measurements and monitoring of energy related organic effluents. Saturated solutions of individual PAH's were prepared by pumping distilled or salt water through a 'generator column' maintained at constant temperature. Extraction of the generated PAH solutions was through an 'extractor column'. The adsorbed PAH was eluted with a water-acetonitrile solvent blend, and the PAH quantified using a dynamic coupled column liquid chromatographic procedure. This technique was used to obtain solubility data on 12 PAH's (benzene, naphthalene, fluorene, anthracene, phenanthrene, 2-methylanthracene, 1-methylphenanthrene, fluoranthene, pyrene, 1,2-benzanthracene, chrysene, and triphenylene) over the temperature range 5-30C. The precision of duplicate solubility measurements was better than + or - 2%. Enthalpies of solution were calculated to describe the effect of salinity upon solubility. The partitioning of several PAH's between aqueous solutions and sediment samples was investigated. (Brambley-SRC)
W81-02943

SAMPLERS AND SAMPLING PROCEDURES FOR HAZARDOUS WASTE STREAMS,
California Dept. of Health Services, Berkeley.
For primary bibliographic entry see Field 7B.
W81-02946

HEXAVALENT CHROMIUM IN GROUND AND SURFACE WATERS NEAR TELLURIDE, COLORADO -- A PRELIMINARY DATA REPORT --,
Geological Survey, Denver, CO. Water Resources Div.
D. B. Grove, R. L. Miller, L. F. Konikow, and P. S. O'Boyle.
Geological Survey Open-File Report 79-700, 1979. 17 p, 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Chromium, *Water quality, *Groundwater, *Surface water, Water pollution, Mine wastes, Surveys, Water supply, Groundwater movement, Solute transport, Data collections, Sampling, Sites, Water analysis, *Colorado, *Telluride, Hexavalent chromium.

Data showing results of 38 groundwater and 25 surface-water samples analyzed for hexavalent chromium are presented. Most samples were taken within the Telluride, Colo., city limits during October 1978. Twenty-four of the 38 groundwater samples (63%) contained more than 50 micrograms per liter of hexavalent chromium. Excluding the mill tailings pond 6 of the 23 surface-water samples (26%) contained more than 50 micrograms per liter of hexavalent chromium. Hexavalent chromium concentrations in groundwaters ranged from 0 to 2700 micrograms per liter and in surface waters from 0 to 160 micrograms per liter. (USGS)
W81-02982

QUALITY OF WATER IN THE TALLAHATCHIE RIVER NEAR NEW ALBANY, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $5.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1187, 1981. 36 p, 9 Fig, 1 Tab, 10 Ref.

Descriptors: *Water quality, *Surface water, *Streamflow, *Water pollution, Municipal wastes, Urban runoff, Bacteria, Data collections, Sampling, Sites, Water analysis, Mississippi, *Tallahatchie River, Union County(MS).

The quality of water in the Tallahatchie River was somewhat affected by municipal wastes as it flowed through a 5-mile stretch near New Albany, Miss. Specific conductance, biochemical oxygen demand, nitrogen and phosphorus concentrations, and densities of bacteria in the river increased in a downstream direction. At site 1 (upstream) the mean concentration of total nitrogen was 0.28 milligram per liter with a mean total phosphorus concentration of 0.05 milligram per liter. At site 3 (downstream) mean-total nitrogen and phosphorus were 0.48 and 0.14 milligram per liter respectively. Specific conductance ranged from 90 to 125 micromhos per centimeter at site 1 and from 155 to 175 at site 3. The fecal coliform to fecal streptoccai bacteria ratio of most samples at site 1 was less than 2.0. At site 3 the ratio exceeded 4.0 in most samples indicating wastes of human origin were probably present. (USGS)
W81-02986

MAGNITUDE AND CHEMICAL QUALITY OF BASE FLOW OF OTTER CREEK, TONGUE RIVER, AND ROSEBUD CREEK, SOUTHEASTERN MONTANA, OCTOBER 26-NOVEMBER 5, 1977,
Geological Survey, Helena, MT. Water Resources Div.
R. W. Lee, S. E. Slagle, and J. R. Stimson.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO. 80225, Price: $4.75 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-1298 (WRI). February, 1981. 25 p, 1 Fig, 6 Tab, 4 Ref, 1 Plate.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Descriptors: *Water quality, *Streams, *Base flow, Surface-groundwater relations, Effluent streams, Path of pollutants, Data collections, Sampling, Sites, Flow measurement, Water temperature, Water properties, Chemical analysis, *Montana, Southeastern Montana, Otter Creek, Tongue River, Rosebud Creek.

Hydrologic and chemical data were collected during base-flow conditions on three streams in southeastern Montana from October 26 to November 5, 1977, to characterize groundwater discharge. Maximum measured flow of Otter Creek, an interrupted stream, was 1.2 cubic feet per second. The water chemistry was dominated by sodium, magnesium, and sulfate ions, with a maximum dissolved-solids concentration of 3,540 milligrams per liter. Chemistry of groundwater inflow is dominated by sodium, magnesium, and sulfate. A discharge of 156 cubic feet per second from the Tongue River Reservoir into the Tongue River complicated interpretation of groundwater discharge to the reach downstream from the reservoir. Many reaches of gain and loss were observed along the Tongue River; the flow near the mouth was 233 cubic feet per second. Minor changes in quality of the base flow indicate groundwater discharges dominated by sodium, sulfate, and bicarbonate plus carbonate. Dissolved-solids concentration increased from 506 milligrams per liter near the dam to 630 milligrams per liter near the mouth. Maximum measured flow of Rosebud Creek was 19.0 cubic feet per second. Water quality in the upper reaches was dominated by magnesium, calcium, and bicarbonate, with dissolved-solids concentrations ranging from 560 to 703 milligrams per liter. Sodium, sulfate, and dissolved solids increase downstream. (USGS)
W81-02988

QUALITY OF SURFACE WATER IN THE SUWANNEE RIVER BASIN, FLORIDA, AUGUST 1968 THROUGH DECEMBER 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02992

COMPARISON OF THE PROPANE-AREA TRACER METHOD AND PREDICTIVE EQUATIONS FOR DETERMINATION OF STREAM-REAERATION COEFFICIENTS ON TWO SMALL STREAMS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
L. B. House, and S. Skavroneck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-202400, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-105, January, 1981. 18 p, 3 Fig, 6 Tab, 19 Ref.

Descriptors: *Tracers, *Streamflow, *Mathematical studies, Hydraulic geometry, Data collections, Oxygenation, *Dissolved oxygen, Water pollution, Evaluation, *Wisconsin, *Reaeration coefficient, *Hydrocarbon gas tracers, Propane.

This study was conducted to identify the best predictive equations for a stream's reaeration-rate coefficient. Reaeration-rate information is needed in dissolved-oxygen modeling work, but an actual tracer measurement is not always possible. The propane-area gas-tracer method and predictive equations were compared for determination of stream-reaeration coefficients for reaches of two small streams in Wisconsin. The study was a cooperative effort with the Wisconsin Department of Natural Resources. The reaeration-rate coefficients actually measured by the propane-area tracer technique were 14.0 per day and 10.5 per day for two reaches of Honey Creek near Monroe, Wis., with 6.98 per day and 0.98 per day measured at separate reaches on Mill Creek near Marshfield, Wis. Of 20 predictive equations evaluated, the top five ranking equations were as follows: Tsivoglou-Neal with 34% mean error, Foree with 34.8%, Cadwallader with 45.5%, Isaacs-Gaudy with 45.8%, and Langbein-Durum with 49%. (USGS)
W81-02995

HIGH SPEED LIQUID CHROMATOGRAPHY AS AN ENVIRONMENTAL MONITOR OF NON-VOLATILE ORGANIC POLLUTANTS IN WATER: IN RETROSPECT--A NEW PERSPECTIVE,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 5C.
W81-03002

ORGANIC POLLUTANTS IN GROUND-RECHARGED WATER,
Arizona Univ., Tucson. Dept. of Chemistry.
C. Steelink, H. Bohn, M. Mikita, K. Thorn, and J. Hobson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205122, Price codes: A03 in paper copy, A01 in microfiche. Project Completion Report, April, 1981. OWRT A-080-ARIZ(1), 14-34-0001-0103.

Descriptors: Phenols, Humic acid, *Organic compounds, Water reuse, Water purification, Pollutants, *Water pollution sources, *Pollutant identification, *Water treatment, Chloroform, THM, Trihalomethane, THMP, *Ground-recharging, Secondary effluent, Phoenix Water Supply, Phenol analysis, Humic acid analysis, Toxic organic compounds.

The objective of this project was to determine the identities of the haloforms (THMs) in ground recharged water as well as the concentrations and identities of the haloform precursors (THMPs). A second objective was the determination of these compounds in the waters supplying the ground-recharge facility operated by the USDA Water Conservation Laboratory, Phoenix, Arizona. These water supplies included the Salt and Verde Rivers, the water treatment plants and the sewage treatment plant. Since ground recharging has been proposed as a method for rendering secondary effluent safe for a number of uses, we initiated this study to test the efficiency of ground recharging in the removal of toxic haloforms. Our results demonstrate that ground recharging: (1) removes all haloforms; (2) reduces phenolic content to one-third of the influent value; (3) reduces humic acid content to one-third the influent values and (4) reduces total organic carbon to one-fourth its former value. Fifty percent of the haloform precursors (THMPs) are also removed. Data from other parts of the municipal water systems show that the Salt and Verde Rivers are free of haloforms, but they do contain significant amounts of phenolic compounds. Small amounts of haloform are found in the treated waters, but the amounts of phenols and humates are very low compared to the river water. A significant amount of haloform precursor (THMP) is found in both the river and treated waters. However, very little THMP is found in the secondary effluent, despite its high content of organic carbon.
W81-03008

SAMPLING AND PRECONCENTRATION METHODS FOR THE ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER SYSTEMS,
Connecticut Univ., Storrs. Dept. of Chemistry.
S. R. Smith, J. Tanaka, D. J. Futoma, and T. E. Smith.
CRC Critical Reviews in Analytical Chemistry, Vol 10, No 4, p 375-426, February, 1981. 25 Fig, 8 Tab, 84 Ref. OWRT-A-084-CONN(1).

Descriptors: Preconcentration methods, Sampling, *Distribution systems, *Polycyclic aromatic hydrocarbons, *Water supply, Pollutant identification.

The determination of polycyclic aromatic hydrocarbons (PAH) in water systems is at present being studied with great interest since a large number of PAH have been shown to be highly carcinogenic. The analyst is confronted by a number of problems in the analysis of PAH in water samples. The first problem is that the concentration of individual PAH range from less than 1 ppt (pg/g) in pure groundwater supplies to greater than 1 ppm (ug/g) in heavily contaminated sewage. These concentrations necessitate the application of some extractions or preconcentration technique. The second problem occurs when handling solutions where the concentrations of the solute are in a range less than 1 ppm. Serious errors can arise from losses or contamination in sampling. The third problem is that the PAH may represent as little as 0.01% of the organic fraction present in the water sample. The techniques that have been reviewed here have been used to extract and concentrate the PAH from water samples include adsorption methods, solvent extraction headspace analysis, steam-distillation, and coupled-column chromatography.
W81-03013

LIQUID CHROMATOGRAPHIC DETERMINATION OF SELECTED CARBAMATE PESTICIDES IN WATER WITH ELECTROCHEMICAL DETECTION,
North Dakota State Univ., Fargo. Dept. of Chemistry.
J. L. Anderson, and D. J. Chesney.
Analytical Chemistry, Vol 52, No 13, p 2156-2161, November, 1980. 7 Fig, 2 Tab, 37 Ref. OWRT-A-049-NDAK(2) and B-043-NDAK(2).

Descriptors: *Pollutant identification, *Carbamate pesticides, *Water analysis, Pesticides, Analytical techniques, Chromatography, Aminocarb, Carbendazim, Chlorpropham, Desmedipham, Dichloran, Phenmedipham.

Traces of carbamate pesticides in water were determined by reverse-phase liquid chromatography with electrochemical detection. The thin-layer, Kel-F graphite electrochemical detector was operated in the oxidative, constant-potential amperometric mode at +1.1 V vs Ag-AgCl-3.5 M KCl. Detection limits of samples with concentrations of 2-7 ppb were 40-150 picograms (signal/noise ratio 2:1). Pesticides successfully determined under the conditions described were aminocarb, carbendazim, chlorpropham, desmedipham, dichloran, and phenmedipham. For various reasons asulam, chloramben, carbaryl, picloram, and PBMC did not produce good results under the analytical conditions. Further work is necessary to apply this method to these pesticides. (Cassar-FRC)
W81-03014

METHODS FOR ESTIMATING THE NUMBER OF IDENTIFIABLE ORGANIC POLLUTANTS IN THE AQUATIC ENVIRONMENT,
Sangamon State Univ., Springfield, IL. Math Systems Program.
K. G. Janardan.
Water Resources Research, Vol 17, No 1, p 243-249, February, 1981. 1 Fig, 5 Tab, 16 Ref.

Descriptors: *Organic compounds, *Aquatic environment, *Estimating, Water pollution, Statistical methods, Pollutants, Analytical techniques, Water analysis, Pollutant identification.

Shackelford and Keith (1976) compiled data on organic chemicals, excluding pesticides, found in 33 different types of water. The 1,258 distinct compounds identified were listed according to frequency of appearing in samples: 503 appeared once, 238 twice, etc. This paper applies several statistical approaches for estimating unseen objects in a population to problems of estimating the number of organic pollutants likely to be found in an aquatic environment. The total number of identifiable distinct compounds estimated using these procedures was between 2,500 and 9,300. As new compounds are produced, the rate of generation must be compared with the theoretical rates. If the actual rate is higher or lower than expected, this may indicate misidentification, lack of sensitivity in analytical methods, etc. (Cassar-FRC)
W81-03069

EXTRACTION AND CLEANUP OF FISH, SEDIMENT, AND WATER FOR DETERMINATION OF TRIARYL PHOSPHATES BY GAS-LIQUID CHROMATOGRAPHY,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. C. G. Muir, N. P. Grift, and J. Solomon.

Journal of the Association of Official Analytical Chemists, Vol 64, No 1, p 79-84, January, 1981. 2 Fig, 5 Tab, 11 Ref.

Descriptors: *Phosphates, Analytical techniques, *Pollutant identification, *Gas liquid chromatography, Sediments, Fish, Water, Chemical wastes, Inorganic compounds, Water pollution sources, Pollutants, Chromatography.

Several extraction solvents and cleanup techniques were evaluated for the recovery of tricresyl phosphate (TCP) isomers, cresyl diphenyl phosphate (CDP), and C-14 labeled triphenyl phosphate (TPP) from environmental samples. Gel permeation chromatography/alumina column chromatography were used to clean up the fish sample extracts. Sediment extracts were treated by alumina only. Gas-liquid chromatography with nitrogen-phosphorus detection was used to identify the compounds present. The results of the study suggest that procedures for the determination of organochlorine pesticide residues and other similar organics can be readily adapted for determining triaryl phosphates. It is suggested that caution be exercised in interpreting the GLC results obtained with nitrogen-phosphorus detectors, as it is possible that interference may result at the low (microgram/g) range and because it may be hard to chromatograph the complex mixture of isomers in actual triaryl phosphate products. (Baker-FRC)
W81-03071

DETERMINATION OF ORGANIC CONTAMINANTS BY THE GROB CLOSED-LOOP-STRIPPING TECHNIQUE,

Environmental Protection Agency, Cincinnati, OH.
W. E. Coleman, R. G. Melton, R. W. Slater, F. C. Kopfler, and S. J. Voto.
Journal of the American Water Works Association, Vol 73, No 2, p 119-125, February, 1981. 10 Fig, 5 Tab, 28 Ref.

Descriptors: *Organic compounds, *Pollutant identification, Analytical techniques, *Gas chromatography, Monitoring, Measuring, Water analysis, Water quality.

The applications of a Grob closed-loop-stripping device to concentrate organic contaminants in drinking water are described. Grob uses carbon disulfide to elute the organics off the activated carbon and gas chromatography to separate the organics in the eluent. The Grob CLSA method is a vapor-phase stripping method by which those compounds with appreciable vapor pressures over water are removed from the sample by purging it with a large volume of gas and passing the stripping gas through an adsorption tube. Unlike other vapor-phase methods, this method has achieved a millionfold concentration of most low and intermediate molecular weight organics by using a closed-loop design. In the process, 0.5 liter of stripping gas is recycled continuously through the water sample, and the adsorption trap is extracted with 10 microliters of carbon disulfide. Quantitative analysis is achieved by spiking the initial water sample with a series of internal standards, by stripping at 30 degrees for two hours, and by chromatographing the carbon disulfide extract on a WCOT (GC) column. The method may be employed for monitoring, for analytical steps in epidemiological studies, for granular activated carbon evaluation, and in recovery studies. (Baker-FRC)
W81-03080

ORGANIC COMPOUNDS PRODUCED BY THE AQUEOUS FREE-CHLORINE-ACTIVATED CARBON REACTION,

Illinois Univ. at Urbana-Champagin. Dept. of Civil Engineering.
V. L. Snoeyink, R. R. Clark, J. J. McCreary, and W. F. McHie.
Environmental Science and Technology, Vol 15, No 2, p 188-192, February, 1981. 2 Fig, 4 Tab, 20 Ref.

Descriptors: *Activated carbon, *Chlorination, *Organic compounds, Trihalomethanes, Pollutant identification, Water pollution sources, Potable water, *Water treatment, Chemical reactions, Water purification.

The high molecular weight brown-black compounds formed upon reaction of virgin granular activated carbon with high doses of chlorine (2 g Cl2 per g carbon) were not mutagenic in several bacterial test systems. Although the material contained carbonyl and hydroxyl groups, was water soluble and highly oxidized, little else was revealed by structural studies. Volatile organics were also produced at high doses of chlorine (2.5 g per g carbon). At pH 1.7, chloroform, carbon tetrachloride, and dichloropropene were formed; at pH 7.8 and 11.5, additional chlorinated hydrocarbons, plus hexane, benzene, and toluene were formed. At lower Cl2 dosages (10-50 mg Cl2 per liter or less) volatile organics were not produced. solvent extraction of the columns and effluent yeilded no additional chlorinated compounds. The low concentrations of chlorine used in chlorinating drinking water are unlikely to produce undesirable amounts of chlorinated hydrocarbons or black-colored materials when in contact with virgin granular activated carbon. (Cassar-FRC)
W81-03087

FAILURE OF THE MOST-PROBABLE-NUMBER TECHNIQUE TO DETECT COLIFORMS IN DRINKING WATER AND RAW WATER SUPPLIES,

Oregon State Univ., Corvallis. Dept. of Microbiology.
T. M. Evans, C. E. Waarvick, R. J. Seidler, and M. W. LeChevallier.
Applied and Environmental Microbiology, Vol 41, No 1, p 130-138, January, 1981. 4 Fig, 5 Tab, 34 Ref.

Descriptors: *Potable water, *Water analysis, *Coliforms, Bacteria, Water quality control, *Pollutant identification, Analytical techniques, Microorganisms, Membranes.

Interferences in the standard most probable number (S-MPN) technique for coliform enumeration of untreated surface waters and potable water were demonstrated in a comparison with a modified MPN procedure. This modified method uses the standard method with additional steps to recover coliforms from any negative tests. False-negative results were obtained in all tests of the S-MPN technique (presumptive, confirmed and completed), the presumptive test being most susceptible to interference. In untreated raw water samples the modified method detected greater numbers of coliforms in 80-85% of samples. In drinking water the S-MPN method gave low counts in 92% of samples. The modified method increased the incidence of coliform-positive water samples by 100%: for example, the modified method detected coliforms in 42 of 100 samples; S-MPN, 22; and the standard membrane filter technique, 23. Eight different species of coliforms were found in false-negative tests from the S-MPN method, including Citrobacter, Enterobacter, Klebsiella, and Escherichia coli. Although the S-MPN and membrane filter procedures underestimated and failed to detect coliforms in potable water, it is not yet practical to substiute the MPN method, which is still undergoing alterations and field tests. (Cassar-FRC)
W81-03091

IRON BACTERIA IN DRINKING-WATER DISTRIBUTION SYSTEMS: ELEMENTAL ANALYSIS OF GALLIONELLA STALKS, USING X-RAY ENERGY-DISPERSIVE MICROANALYSIS,

California Univ., Irvine. Environmental Analysis Div.
H. F. Ridgway, E. G. Means, and B. H. Olson.
Applied and Environmental Microbiology, Vol 41, No 1, p 288-297, January, 1981. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Iron bacteria, *Bacteria, *Pipes, Gallionella, Pollutant identification, Microorganisms, Distribution systems, Potable water, Water supply systems.

Gallionella, belonging to the iron bacteria genus, were collected from the inner surfaces of pipes in a 25-year old water main and from water samples. The characteristic helical stalks were coated with insoluble ferroaluminosilicate deposits. X-ray energy-dispersive microanalysis revealed that Si, Al, Ca, and Fe were predominant, with smaller quantities of P, S, Cl, Cu, and Zn. Although Mn was present in the water, none was found in the stalks. This study was the first to examine Gallionella stalks directly from the environment without prior subculturing. (Cassar-FRC)
W81-03092

POLYCHLORINATED BIPHENYLS IN SEDIMENTS OF THE TIDAL HUDSON RIVER, NEW YORK,

Lamont-Doherty Geological Observatory, Palisades, NY.
R. F. Bopp, H. J. Simpson, C. R. Olsen, and N. Kostyk.
Environmental Science and Technology, Vol 15, No 2, p 210-216, February, 1981. 4 Fig, 6 Tab, 24 Ref.

Descriptors: *Polychlorinated biphenyls, *Sediments, *Hudson River, Water pollution sources, Analytical techniques, Measurement, Industrial wastes.

A summary of PCB data collected for the Hudson River system over the past 3 yr is presented. More than 150 samples of sediment were analyzed. Two manufacturing facilities located on the Hudson River between 1950 and 1976 are responsible for much of the PCB quantity found. The sediment samples contained, on the average, 10 ppm, which is 1-2 orders of magnitude greater than the levels of contamination found in other major water areas studied. As one moves further downstream from the sources of contamination, the level diminishes. The two major sources were General Electric capacitor plants located within 2 km of each other. Measurements of Cs-137 have greatly aided in this study of the Hudson River sediments, for they provide an independent time frame for reference. The Cs-137 resulted from the era of atmospheric testing of nuclear devices. The composition of PCBs associated with the sediment in the Hudson can be further elucidated through partitioning of PCB components between water and suspended matter. Detailed, individual peak analysis of chromatograms will provide significant information on the behavior and fate of PCBs. (Baker-FRC)
W81-03098

THE ACTIVITY OF NACL IN SEAWATER OF 10-40% SALINITY AND 5-25C AT 1 ATMOSPHERE,

Oregon State Univ., Corvallis. School of Oceanography.
K. S. Johnson, and R. M. Pytkowicz.
Marine Chemistry, Vol 10, No 2, p 85-91, 1981. 4 Tab, 18 Ref.

Descriptors: *Sodium chloride, *Seawater, *Solutions, Chemical properties, Salinity, Chemical potential, Model studies, Temperature, Water analysis, Electrodes, Electrolytes.

A new set of measurements of the activity of sodium chloride in artificial seawater from 10 to 40% salinity and 5-25 degrees C is presented. These measurements can be used to test the predictions of various models. The total activity coefficient of NaCl in seawater was calculated from the average value of the difference in potentials measured at each salinity and temperature by means of a given equation. The molal mean activity coefficient of NaCl in 35% seawater at 25C was 0.667. The relative partial molal enthalpy of NaCl in 35% seawater was -130 cal/mol. This value is in good agreement with the value measured in pure 0.72 M NaCl. Results were compared with activity coefficients predicted by a specific interaction model and by an ion association model. Good agreement was found. (Baker-FRC)
W81-03104

APPLICATION OF AN AUTOMATED METHOD FOR DISSOLVED SULPHATE ANALYSIS TO MARINE AND BRACKISH WATERS,

Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
A. G. A. Merks, and J. J. Sinke.
Marine Chemistry, Vol 10, No 2, p 103-108, 1981. 2 Fig, 3 Tab, 5 Ref.

Descriptors: *Sulfates, *Analytical techniques, *Seawater, Brackish water, Spectrometry.

An automated method to determine dissolved sulfate has been applied to saline and brackish waters. The method is based on the release of methylthymol blue from the barium-methylthymol blue complex by sulfate. As a number of cations interfere with the determination, pretreatment of the sample is required by passing it over a cation-exchange resin. A small sample volume of less than 2 ml is required, making the method very suitable for analysis of interstitial waters. The method was calibrated for samples from natural waters in the Dutch delta region, containing up to 2500 mg/liter of sulfate, with a salinity of 30%. (Baker-FRC)
W81-03105

SURVEY FOR CADMIUM, COBALT, CHROMIUM, COPPER, NICKEL, LEAD, ZINC, CALCIUM, AND MAGNESIUM IN CANADIAN DRINKING WATER SUPPLIES,
Health and Welfare Canada, Ottawa (Ontario). Health Protection Branch; and Environmental Health Centre, Ottawa (Ontario).
J. C. Meranger, K. S. Subramanian, and C. Chalifoux.
Journal of the Association of Official Analytical Chemists, Vol 64, No 1, p 44-53, 1981.

Descriptors: *Metals, *Potable water, *Canada, Surveys, Water analysis, Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, Magnesium, Analytical techniques, *Pollutant identification, Water quality standards, Trace elements, Drinking water.

A second national survey of Canadian drinking water supplies indicated that median values for selected metals were well below maximum limits set by Health and Welfare Canada and the World Health Organization. Raw, treated, and distributed water samples from 71 municipalities were analyzed by atomic absorption spectrophotometry using the direct method and by an APDC-MIBK extraction procedure. Metal levels did not vary significantly among the 3 types of samples. Median and range of metal concentrations in distributed water as determined by the direct method (expressed as nanograms per ml water) were as follows: Cd <0.02 (range <0.02-0.07), Co <2.0 (<2.0-6.0), Cr <2.0 (<2.0-4.1), Cu <10 (<10-900), Ni <2.0 (2.0-69.0), Pb <1.0 (<1.0-79.7), and Zn <10 (<10-750). Hardness values ranged from 6.7 to 328.3 mg CaCO3 per liter. Although water picked up Pb, Cu, and Zn during treatment and distribution in some areas, other metals caused minimal contamination. (Cassar-FRC)
W81-03111

SPECTROPHOTOMETRIC DETERMINATION OF NITRITE IN WATERS,
Mosul Univ. (Iraq). Dept. of Chemistry.
S. Flamerz, and W. A. Bashir.
Analyst, Vol 106, No 1259, p 243-247, February, 1981. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Spectrophotometry, *Nitrites, *Water analysis, Pollutant identification, Analytical techniques, Nitrogen compounds.

Nitrite in the range 0.1-3 micrograms per ml is determined with accuracy and precision using 0.25% 4-amino salicylic acid and 0.35% naphth-1-ol solution in 1.5% sodium hydroxide solution. Absorbance is measured at 529 nm. A pinkish red color develops immediately and is stable for 36 hours. A table lists interfering ions and their maximum permissible concentrations. Many ions, including heavy metals, can interfere with the analysis and must be removed by ion exchange. (Cassar-FRC)
W81-03127

ISOLATION OF VIBRIO CHOLERAE SEROTYPE 01 FROM THE EASTERN OYSTER, CRASSOSTREA VIRGINICA,
University of West Florida, Pensacola. Dept. of Biology.
M. A. Hood, G. E. Ness, and G. E. Rodrick.
Applied and Environmental Microbiology, Vol 41, No 2, p 559-560, February, 1981. 1 Tab, 6 Ref.

Descriptors: *Bacteria, *Shellfish, *Oysters, Coliforms, Vibrio cholerae, Public health, *Apalachicola Bay, Florida, *Pollutant identification, Microbiology.

Two dozen eastern oysters, Crassostrea virginica, collected from eight stations in approved shellfish harvesting waters of Apalachicola Bay, Florida, contained two strains of Vibrio cholerae Serotype 01. The waters had no history of sewage contamination, and fecal coliforms were low, 210-180 cells per 100 g in the meat and less than 0.03 cells per 100 ml in the water. The public health significance of these strains is not known. (Cassar-FRC)
W81-03128

DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN FOOD, WATER AND SMOKE USING HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Department of Industry, London (England). Lab. of the Government Chemist.
N. T. Crosby, D. C. Hunt, L. A. Philp, and I. Patel.
Analyst, Vol 106, No 1259, p 135-145, February, 1981. 5 Fig, 7 Tab, 19 Ref.

Descriptors: *Water analysis, *Chromatography, *Organic compounds, Aromatic compounds, Polynuclear aromatic hydrocarbons, Pollutant identification, Analytical techniques.

Seventeen polynuclear aromatic hydrocarbons (PAH) were separated by thin layer chromatography and examined by high performance liquid chromatography using octadecylsilane and PPS stationary phases. Elution times relative to benzo (a) pyrene were computed. Samples of bierwurst and water, spiked with 6 representative PAHs, had recovery values of 70-110% and 59-96%, respectively. Water samples are extracted with 2,2,4-trimethyl-pentane, concentrated by evaporation, and redissolved with methanol before injection into the chromatograph apparatus. The limit of detection for benzo (a) pyrene is 0.3 ng per liter in water. (Cassar-FRC)
W81-03129

BACTERIAL DENSITY IN WATER DETERMINED BY POISSON OR NEGATIVE BINOMIAL DISTRIBUTIONS,
Canada Centre for Inland Waters, Burlington (Ontario).
A. H. El-Shaarawi, S. R. Esterby, and B. J. Dutka.
Applied and Environmental Microbiology, Vol 4, No 1, p 107-116, January, 1981. 5 Fig, 4 Tab, 8 Ref.

Descriptors: *Bacteria, *Water analysis, *Statistical methods, Homogeneity, *Pollutant identification, Sampling, *Poisson distribution, Negative binomial distribution, Mathematical studies, Bodies of water, Lake Erie.

Bacterial density of a body of water may be inferred from a number of small-volume samples by using either of two distributions, Poisson or negative binomial. If the bacterial counts are assumed to be homogeneous, the Poisson distribution is applicable. If not, the binomial distribution can be used, dividing the data into smaller groups which can be represented by a Poisson distribution. In one example, the Poisson disribution was suitable for fecal streptococcal counts on beach water samples. In a second example, water samples were collected at various stations during four cruises on Lake Erie over the period May-November, 1968. Bacterial analysis showed that the lake was very heterogeneous, hence the negative binomial distribution was applicable. Suggestions are presented to aid in choosing the positions of sampling stations and the number of samples for the most accurate total bacterial counts. (Cassar-FRC)
W81-03130

WATER AND WASTE PROCESS ANALYTICAL PARAMETERS,
R. H. Babcock.
Water/Engineering and Management, Vol 128, No 1, p 30-32, 91, January, 1981. 3 Fig.

Descriptors: *Laboratory equipment, Waste water treatment, *Water quality, *Water analysis, Hydrogen ion concentration, Turbidity, Dissolved oxygen, Electrodes, Automation, On-site tests, *Pollutant identification.

Many problems still exist in online water and waste water process instrumentation, which may be divided into analysis by wet chemical laboratory methods or evaluations by on-site tests. Direct measurement of such process variables as pH, oxidation-reduction potential (ORP), dissolved oxygen, color, conductivity, turbidity, fluoride, and hardness is now possible. Many physical-chemical analytical techniques use an electrode system consisting of a reference electrode, a measuring electrode, and a thermal element. Three types of electrode systems - the glass membrane, the solid-state membrane, and the liquid-ion exchange type - may be used for determining pH and ion concentrations. ORP electrodes, amperometrically-operating electrodes, dissolved oxygen electrodes and nephelometric equipment are discussed. The measurement of turbidity by nephelometry is examined in detail, and sampling systems for in situ measurements are considered. The instruments mentioned require regular maintenance for accurate laboratory measurements of water and waste water parameters. (Geiger-FRC)
W81-03143

BOTTLED WATER: EXPENSIVE GROUNDWATER,
Shell Oil Co., New Orleans, LA.
J. Studlick, and R. Bain.
Water Well Journal, Vol 34, No 7, p 75-79, July, 1980. 2 Tab.

Descriptors: *Mineral water, Taste, *Drinking water, Water quality, Sulfates, Hardness, *Bottled water, Standards.

Fourteen bottled waters were tested for taste and mineral content. Taste was found to be an extremely individual parameter, and no clear trends were noted. Most of the tested waters met standards of acceptable mineral content. Some were of very good quality while others clearly were unacceptable, with high levels of sulfate, hardness, and other constituents. The quality of bottled water can be affected by the type of container, length of storage, chemical changes during shipment, as well as other factors. Many of the waters tested did not contain at least 500 mg/liter of minerals, the California definition of mineral water. Some consumers are buying bottled water which is actually lower in quality than the water supplied by their local water utility. This may be for reasons of taste or snob appeal. The waters with the highest mineral content were carbonated. (Small-FRC)
W81-03153

EXTRACTABLE ORGANIC MATTER IN URBAN STORMWATER RUNOFF. 2. MOLECULAR CHARACTERIZATION,
California Univ., Los Angeles. Department of Earth and Space Sciences.
R. P. Eganhouse, B. R. T. Simoneit, and I. R. Kaplan.
Environmental Science and Technology, Vol 15, No 3, p 315-326, March, 1981. 5 Fig, 4 Tab, 68 Ref.

Descriptors: *Organic compounds, Urban areas, Storm water, Los Angeles River, Organic matter, Runoff, Path of pollutants, Rivers, Water pollution sources, *Storm runoff, Surface waters, Oil pollution, *Pollutant identification, Analytical techniques, *Urban runoff.

Solvent-extractable organic compounds derived from Los Angeles storm water runoff were charac-

terized after separation into four fractions: total hydrocarbons (branched, cyclic, and aromatic), fatty acids, ketones (predominantly isoprenoids and ketoaromatics), and polar compounds (hydroxy acids, dicarboxylic acids, and sterols). They were examined by high resolution glass capillary gas chromatography with various detection systems. Petroleum hydrocarbons from street surfaces were 60% of the total. Also identified were compounds from biogenic sources such as microorganisms, higher plant debris, and fecal sterols from higher animals. (Cassar-FRC)
W81-03157

INORGANICS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
M. S. Shuman,.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1083-1117, June, 1980. 11 Tab, 399 Ref.

Descriptors: *Inorganic compounds, *Analytical techniques, Separation techniques, *Literature review, Water analysis, Bibliographies.

A review of 1979 published literature on the nature and analysis of inorganic chemical species is presented. Major publications include: the second edition of Treatise on Analytical Chemistry, Part 1, Volume 1, 'Theory and Practice'; Part 2, Volume 10 of the same series; 'Vogel's Textbook of Quantitative Organic Analysis'; the fourth edition of the ASTM 'Manual on Water'; and the EPA 'Manual of Methods for the Chemical Analysis of Water and Wastes' in Spanish. References are included for: isolation, preconcentration, and chromatographic methods; reviews, theory, and metal speciation voltammetric methods; computerized instrumentation voltammetric methods; anodic stripping voltammetry; cathodic stripping; selective electrodes; atomic absorption spectroscopy; and emission spectroscopy and fluorescence techniques. (Small-FRC)
W81-03161

ORGANICS,
Georgia Inst. of Tech., Atlanta.
E. S. K. Chian, H. Meng, F. B. Dewalle, and D. Norman.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1120-1143, June, 1980. 8 Tab, 210 Ref.

Descriptors: *Chemical analysis, *Literature review, *Organic wastes, Hydrocarbons, Pesticides, Waste analysis.

Methods for the detection and identification of organics in water described in the literature published during 1979 are reviewed. Tables summarizing the information available in the literature are presented: methods for detection and identification of detergents and related compounds; of aliphatic and aromatic hydrocarbons; of pesticides, chlorinated hydrocarbons, and related compounds; of naturally occurring organics; and of organics present in surface and groundwater, drinking water, and waste water. Also tabulated are the presence, degradation, and attenuation of: aliphatic and aromatic hydrocarbons; pesticides, chlorinated hydrocarbons, and related compounds; and organics in surface water and waste water. Several papers dealt with the determination of total organics (BOD). (Small-FRC)
W81-03163

VARIABILITY IN IONIC COMPOSITION OF SWEDISH LAKES AND RIVERS,
National Swedish Environment Protection Board, Uppsala. Water Quality Lab.
T. Ahl.
Archiv fur Hydrobiologie, Vol 89, No 1/2, p 5-16, June, 1980. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Lakes, *Rivers, *Acidic water, Sulfates, Ions, Calcium, Magnesium, *Sweden, Sodium, Potassium, Chlorides, Bicarbonates, Nitrates, Chemical analysis, Water analysis, Path of pollutants, Water pollution, Variability, Water quality.

Average concentrations of selected ions in Swedish lakes and rivers as measured in 1971-1975 were as follows (in equivalent %): Ca(2+), 54.9; Mg(2+), 18.4; Na+, 22.6; K+, 4.1; bicarbonate, 42.7; sulfate, 39.1; chloride, 16.5, and nitrate, 1.7. Compared with the global mean, bicarbonates were less (67.1 world average) and sulfates greater (16.3 world average). Concentrations of ions in polar rivers generally followed the Swedish average figures, but other main hydrological regions varied widely, depending on geological conditions, season, water flow, and proximity to the sea. (Cassar-FRC)
W81-03197

CU, PB, AND ZN DETERMINATION IN RAINWATER BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY,
Florence Univ. (Italy). Inst. of Analytical Chemistry.
P. C. Legittimo, G. Piccardi, and F. Pantani.
Water, Air, and Soil Pollution, Vol 14, p 435-441, 1980. 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Heavy metals, *Water analysis, *Rainwater, Metals, Air pollution, Rain, Pollutant identification, Florence, *Italy, Analytical techniques, Copper, Lead, Zinc.

Differential pulse anodic stripping voltammetry was used to determine trace quantities of Cu, Pb, and Zn in rainwater samples collected in Florence, Italy, a nonindustrial city with 500,000 population. Mean metal levels in micrograms per liter were as follows: Zn, 16.2; Pb, 19.6; Cu, 5.7. Rainwater samples from suburbs near the shore, exposed to metal-polluted sea spray, contained much higher levels of the three metals. Greatest sensitivity for Zn was obtained by setting the pulse amplitude at 50 mV. This was satisfactory for the other metals. Although formation of intermetallic compounds has been observed, concentrations encountered in the present samples were 1000 times smaller, and no interference was experienced. (Cassar-FRC)
W81-03200

THE EFFECT OF SAMPLE STORAGE ON THE EXTRACTION OF CU, ZN, FE, MN, AND ORGANIC MATERIAL FROM OXIDIZED ESTUARINE SEDIMENTS,
Geological Survey, Menlo Park, CA.
E. A. Thomson, S. N. Luoma, D. J. Cain, and C. Johansson.
Water, Air, and Soil Pollution, Vol 14, p 215-233, 1980. 5 Fig, 7 Tab, 19 Ref.

Descriptors: *Metals, Sampling, *Sediments, *Separation techniques, Freezing, Drying, Preservation, Analytical techniques, *Pollutant identification, Copper, Zinc, Iron, Manganese, Organic matter, Trace elements, Estuaries.

Concentrations of extractable trace metals (Cu, Zn, Fe, and Mn) and humic material in samples of oxidized extractable estuarine sediments were affected by storage methods. Best results were obtained by extraction within 24 hours. Wet storage at 4C caused variations in extractability due to a shift from oxidized to reduced conditions in the stored samples. Most samples had changed detectably after 15 days at 4C. Freezing preserved samples adequately for most extraction agents used. Drying was satisfactory with the HCl extraction method. (Cassar-FRC)
W81-03207

HOW TO COPE WITH THE SDWA/II,
For primary bibliographic entry see Field 7C.
W81-03209

A METHOD FOR EVALUATING THE ACID-BASE BALANCE IN NATURAL WATERS,
Swedish Water and Air Pollution Research Inst., Goeteborg.
C. Brosset.
Water, Air, and Soil Pollution, Vol 14, p 251-265, 1980. 3 Fig, 5 Tab, 4 Ref.

Descriptors: *Water analysis, *Hydrogen ion concentration, *Fulvic acids, Volumetric analysis, Acidity, Bases, Analytical techniques, Lakes.

The Lee method of determining concentration and acidity constants of one or two weak acids (such as fulvic acid) in lake water was extended to include the total acid-base balance in nine lake water samples. The acid-base system in lake water was considered to have three components: strong base or acid, weak acids (and possibly bases), and carbonic acid. After the weak acids were determined, the other materials were calculated from the titration data. In cases of excess strong acid, results for carbonic acid were not reliable. (Cassar-FRC)
W81-03212

5B. Sources Of Pollution

COST EFFECTIVE STREAM AND EFFLUENT MONITORING,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W81-02901

TRANSPORT MECHANISMS IN SEDIMENT RICH STREAMS HEAVY METAL AND NUTRIENT LOAD OF THE RIO SAN JOSE-RIO PUERCO SYSTEMS,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Chemistry.
D. K. Brandvold, C. J. Popp, and L. Brandvold.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202103, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, Report No 132, February, 1981. 35 p, 4 Fig, 8 Tab, 20 Ref, 2 Append. OWRT-B-062-NMEX(1), 14-34-0001-9085.

Descriptors: Suspended sediments, *Heavy metals, Bed-load, Transport mechanisms, *Nutrients, *Industrial wastes, *New Mexico, Streams, Dissolved solids, *Water pollution sources, Path of pollutants, Rio Puerco, Rio San Jose, *Uranium mining, Sediment rich streams.

Because of the possibility that uranium mining and milling activities could contribute harmful substances to surface water, the project purpose was to determine physical and chemical characteristics of water and sediments in the San Jose-Puerco River system in New Mexico. Water samples were analyzed for general chemistries, sediment load, nutrients, heavy metals and radioactivity. Suspended sediments and bed-load sediments were analyzed for heavy metals and radioactivity. Dissolved metals in the Rio San Jose were not elevated with respect to the Rio Puerco. The lower Rio Puerco showed elevated levels of Mo and V with respect to the Rio Grande. Elevated levels of As, Cd, Co, Hg, Mo, U, V, and Zn were found in Rio San Jose suspended sediments. Analyses of bed-load sediments indicated elevated levels of As, Hg, and U in both the Rio San Jose and Rio Puerco. An attempt was made to study the means of transport of the elevated species.
W81-02902

CONTAMINANT TRANSPORT IN HYDROGEOLOGIC SYSTEMS,
Texas A and M Univ., College Station. Water Resources Inst.
C-S. Chen, and D. L. Reddell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202079. Price codes: A07 in paper copy, A01 in microfiche. Techical Report No 114, March, 1981. 118 p, 2 Tab, 26 Ref, 4 Append. OWRT-A-048-TEX(1), 14-34-0001-9046, 14-34-0001-0146, 14-34-0001-1146.

Descriptors: *Heat transfer, *Pollutants, *Geohydrologic boundaries, *Geohydrology, *Ion transport, *Mathematical models, *Aquifer testing, Groundwater movement, Baseflow, Inorganic compounds, Ions, Model studies, Aquifers, Aquifer systems, Aquifer characteristics, Temperature gra-

dient, Thermal stratification, Thermal conductivity, Thermal capacity, Isotherms.

The transportation process of a specific conservative ion species is analogous to transport of heat in the system. Analytical models of hot water injection into groundwater aquifers were developed. Two models were developed to examine the influence of a caprock of finite thickness on the thermal response of an aquifer. Model I assumed a linear vertical temperature gradient in the caprock, approachable in a caprock of relatively small thickness; model II allowed this gradient to be nonlinear. For model I, a steady state and unsteady state solution for water temperature distribution surrounding an injection well were obtained; while model III yielded a steady state and two unsteady state solutions, one for a short-time and one for a long-time period. A graphical technique was developed to determine four pertinent aquifer thermal properties: horizontal thermal conductivity and thermal capacity of the aquifer; vertical thermal conductivity and thermal capacity of the caprock. The caprock thickness was found to influence aquifer temperature distribution only when the time after injection is long. (Zielinski-IPA)
W81-02907

THE BIODEGRADATION OF 2,4,6-TRICHLOROPHENOL IN THE DELAWARE RIVER WATER AND SEDIMENTS AND IN URBAN RUNOFF,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
L. A. Blades-Fillmore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202129, Price codes: A07 in paper copy, A01 in microfiche. Master of Science Thesis, October, 1980. 121 p, 31 Fig, 16 Tab, 63 Ref, Append. OWRT-B-071-NJ(1).

Descriptors: *Biodegradation, Pollution load, Pollutants, *Phenols, *Industrial wastes, *Delaware River, *Halogenated pesticides, Sediments, Degradation, Microbial degradation, Biocontrol, Rivers, Environmental protection, Water pollution sources, Phenolic pesticides, Chlorinated hydrocarbons, Sediment-water interfaces, Urban runoff, Runoff, Water quality, Gas chromatography, Chromatography.

This EPA Priority Pollutant (246-TCP) was selected because it has been found in the Delaware River at about one microgram/liter (mgpl), and since has documented hazardous effects. EPA's 24-hour water quality standard is 52 mgpl; 50 mgpl was used as the experimental concentration. Simulated reservoirs, established from sampling sites covering the industrialized stretch of the Delaware River, modeled water alone and the sediment/water interface (SWI). Several biodegradation phenomena were observed in monitoring 246-TCP disappearance by gas chromatography. Regarding the SWI, biodegradation occurred insignificantly in the water column, but significantly by microorganisms attached to the surface. Regression analysis showed no significant relationship between sampling site and biodegradation rate. Presence of other carbon sources decreased 246-TCP biodegradation 25-40%. A 10-degree temperature decrease slowed biodegradation by factors of 1.4 and 2.3 for SWI and water alone, respectively. Biodegradation kinetics in water was found related to the initial 246-TCP concentration, but not directly proportional, and was neither first nor zero order. In urban runoff before/after a storm event, 246-TCP degraded slower in runoff than in the receiving waters, which degrade 246-TCP at the same rate as prior to runoff influx. (Zielinski-IPA)
W81-02909

DATA ON GROUND-WATER QUALITY WITH EMPHASIS ON RADIONUCLIDES, SARASOTA COUNTY, FLORIDA.
Geological Survey, Tallahassee, FL. Water Resources Div.
H. Sutcliffe, Jr., and R. L. Miller.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225. Price: $2.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1223, 1981. 13 p, 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Groundwater, *Water quality, Water supply, *Uranium radioisotopes, *Radium radioisotopes, Chemical analysis, Sampling, Data collections, Water management, *Florida, Sarasota County, Path of pollutants.

A compilation of analytical results are presented for selected radiochemical and chemical characteristics for 200 groundwater samples collected from 92 wells in Sarasota County, Fla. Radium-226 analysis was made on 160 of the water samples and 80 samples equaled or exceeded the 5 picocuries per liter maximum contaminant level established by the National Interim Primary Drinking Regulations. (USGS)
W81-02926

DIRECT PHOTOLYSIS OF HEXACYANOFERRATE COMPLEXES; PROPOSED APPLICATIONS TO THE AQUATIC ENVIRONMENT,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries, and Wildlife.
S. J. Broderius, and L. L. Smith, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151558, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-003, January, 1980. 59 p, 14 Fig, 9 Tab, 39 Ref, 1 Append. R805291.

Descriptors: *Chemical reactions, *Cyanide, Water pollution, *Water pollution sources, *Iron compounds, Water depth, Wavelengths, Water temperature, Hydrogen ion concentration, Kinetics, Photolysis, Light penetration, Photolysis.

The photochemical response of hexacyanoferrate (II) and (III) complexes under natural light conditions in natural bodies of water, both near the surface and as a function of depth, was investigated to allow evaluation of the relative importance of these compounds as sources of toxic hydrocyanic acid (HCN) in natural waters. Light of wavelengths <480 nm is active in the photolysis reactions and the reaction rates are increased with decreasing pH in the range 9.0-6.6, with decreasing pH in the range 9.0-6.6, with decreasing temperature, and with decreasing concentration. The photolysis reactions can be approximately described by first-order kinetics for concentrations up to 100 microgram per liter. The minimum, near surface, midday direct half-lives for hexacyanoferrate (II) solutions containing 100 microgram per liter CN ranged from about 50 min in late fall to about 18 min in mid summer at St. Paul, Minnesota. The comparable half-lives for hexacyanoferrate (III) were 160 min and 64 min. The half-lives and the amplitude of their seasonal variation should increase with increasing northern latitude. The photolysis rate at various fixed depths in a natural water column, when compared with that at the surface, decreases exponentially with depth, but the reactions are enhanced by turbidity. The potentially rapid photodecomposition of iron-cyanides with the formation of HCN suggests that this phenomenon may be of toxicological importance under certain environmental conditions. (Brambley-SRC)
W81-02945

GEOLOGICAL AND HYDROCHEMICAL SENSITIVITY OF THE EASTERN UNITED STATES TO ACID PRECIPITATION,
Brookhaven National Lab., Upton, NY.
G. R. Hendrey, J. N. Galloway, S. A. Norton, C. L. Schofield, and P. W. Shaffer.
Environmental Protection Agency Report EPA-600/3-80-024, January, 1980. 110 p, 43 Fig, 12 Tab, 105 Ref. IA 79-D-X0672.

Descriptors: *Acid rain, *Bedrock, *Alkalinity, *Hydrogen ion concentration, Streams, Geologic mapping, Fish, Soil chemistry, Environmental effects, Aquatic life, Model studies, Eastern United States.

A new analysis of bedrock geology maps of the eastern U. S. constitutes a simple model for predicting areas which might be impacted by acid precipitation and it allows much greater resolution for detecting sensitivity than has previously been available for the region. Map accuracy has been verified by examining current alkalinities and pH's of waters in several test states, including Maine, New Hampshire, New York, Virginia and North Carolina. In regions predicted to be highly sensitive, alkalinities in upstream sites were generally low, < 200 microequivalents per liter. Many areas of the eastern U.S. are pinpointed in which some of the surface waters, especially upstream reaches, may be sensitive to acidification. Pre-1970 data were compared to post-1975 data, revealing marked declines in both alkalinity and pH of sensitive waters of two states tested, North Carolina, where pH and alkalinity have decreased in 80% of 38 streams ($p < 0.001$) and New Hampshire, where pH in 90% of 49 streams and lakes has decreased ($p < 0.001$) since 1949. These sites are predicted to be sensitive by the geological map on the basis of their earlier alkalinity values. Thus this mapping of sensitive areas is validated by the observed temporal trends. The map is to be improved by the addition of a soils component. Impacts of acidification on aquatic biota are reviewed and a Norwegian model of impacts on fish was calibrated and verified using North American data. (Brambley-SRC)
W81-02952

SOURCES AND TRANSPORTS OF COAL IN THE DULUTH-SUPERIOR HARBOR,
Minnesota Univ.-Duluth. Dept. of Physics.
M. Sydor, and K. Stortz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-147283, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-007, January, 1980. 94 p, 37 Fig, 10 Tab, 48 Ref. R-803952.

Descriptors: *Lake Superior, *Particulate matter, *Dusts, *Coal, *Mass transfer, Water pollution sources, Winds, Mathematical models, Harbors, Ships, Transportation, Remote sensing, Albedo, Path of Pollutants.

Dispersion of particulates from the ORTRAN coal transshipment facility was investigated to estimate the input of coal dust into Duluth harbor and to determine the transport of coal particulates to Lake Superior. A numerical model was used to discuss dispersal of contaminants and determine the residence time of pollutants in the waterway. The model was verified using measurements of water levels, currents, and water quality parameters. Windblown dust was the major source of coal particulates for the harbor, resulting from wind action on the pile, and pile grooming by caterpillar tractors. About 20 metric tons of coal particulates are deposited in the harbor annually. The ship loading operation is a major source of coarse particulates, and this material is further dispersed by resuspension due to ship traffic. The concentration of coal particulate in the shipping channels ranges from 1-20 microgram/l, roughly 0.1% of the average concentration of the suspended solids in the harbor. Less than 1% of the coal dust (50-250 kg/yr) moves from the habor water into the lake. The numerical model for the harbor was used to estimate the transport of resuspended material to Lake Superior. Remote sensing data correlated with measurements of dustfall and snow reflectivity were used to identify the major dust sources in the harbor. (Brambley-SRC)
W81-02953

EFFECTS OF ACID PRECIPITATION ON SOIL LEACHATE QUALITY, COMPUTER CALCULATIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito, A. L. Page, and M. E. Frink.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-137755, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-015, January, 1980. 47 p, 1 Fig, 27 Tab, 26 Ref. B0836NAEX.

Descriptors: *Acid rain, Anions, Cations, *Environmental effects, *Soil chemistry, Computer programs, Equilibrium, *New England, Heavy metals,

Hydrogen ion concentration, Cation exchange, *Leachates.

The multipurpose computer program GEOCHEM was employed to calculate the equilibrium speciation in 23 examples of acid precipitation from New Hampshire, New York, and Maine, and in the same number of mixtures of acid precipitation with minerals characteristic of soils in the same three states. Between 100 and 200 soluble inorganic and organic complexes were taken into account in each speciation calculation. The calculations performed on the acid precipitation samples showed that the metals (including heavy metals) and the sulfate, chloride, and nitrate ligands would be almost entirely in their free ionic forms, while the phosphate, carbonate, ammonia, and organic ligands would be in their protonated forms. This result was independent of the geographic location of the acid precipitation and the month of the year in which the sample was collected. The speciation calculations on the precipitation-soil mineral mixtures showed that aluminum and iron levels in a soil solution affected by acid precipitation would be significantly higher than in one whose chemistry is dominated by carbonic acid. The higher levels found were caused by the lower pH value of acid precipitation as well as by complexes formed with inorganic and organic ligands. It was also shown that soil cation exchangers would absorb preferentially heavy metals, such as Cd and Pb, which are found in acid precipitation. (Author's abstract)
W81-02954

FRESHWATER MICRO-ECOSYSTEM DEVELOPMENT AND TESTING OF SUBSTITUTE CHEMICALS,
Environmental Protection Agency, Beltsville, MD. Pesticide Degradation Lab.
For primary bibliographic entry see Field 5C.
W81-02956

THE ENVIRONMENTAL IMPACT OF COAL TRANSFER AND TERMINAL OPERATIONS,
Hampton (Delon) and Associates, Silver Spring, MD.
L. Pelham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-104747, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S7-80-169, December, 1980. 4 p.

Descriptors: *Coal, *Industrial waste water, *Leachates, *Runoff, *Water pollution sources, Trace elements, Organic matter, Coal mines, Mine wastes, Industrial water use, Mineral industry, Slurries, Water pollution control, Environmental effects, Reclaimed water, Impaired water use, Available water, Coal transport, Coal terminals, Coal storage.

Loading, unloading, stacking, and reclaiming coal can contribute to changes in water quality due to the interaction of water with dust fallout and coal spillage. Coal stockpiles and storage areas exposed to the environment are a potential source of water pollution. Coal storage piles produce effluents during and after precipitation resulting from the drainage and runoff of water. Pollutants include organic substances, mineral matter, and trace elements. Slurry transportation of coal requires large quantities of water, although these amounts are less than would be required for most minemouth utilizations of coal. Water from short pipelines can be recycled. When the pipeline is long, adequate water resources must be available. Air pollution, noise and aesthetic impacts also occur at coal transfer and terminal facilities, but can be lessened by employing proper control methods. Coal slurry transportation depends upon the availability of water in sufficient quantities. Alternate water supply sources should be investigated as part of site selection, either to supplement or substitute available freshwater supplies. Control techniques available for reducing the impact of waste water are: techniques that reduce runoff and leachate flow, and techniques that remove pollutants from runoff and leachate wastes. (Moore-SRC)
W81-02961

CONCENTRATIONS OF ETHOPROP IN THE SOIL AND RUNOFF WATER OF A SMALL AGRICULTURAL WATERSHED,
Science and Education Administration, Tifton, GA.
W. A. Rohde, L. E. Asmussen, E. W. Hauser, and A. W. Johnson.
Agricultural Research Results ARR-S-2, October, 1979. 14 p, 5 Fig, 4 Tab, 8 Ref.

Descriptors: *Water pollution sources, *Pesticide residues, *Agricultural runoff, *Ethoprop, Leaching, Nematicides, Agricultural watersheds, Storm seepage, Surface runoff.

The dissipation in soil and movement in runoff water of the nematicide ethoprop (O-ethyl S,S-dipropyl phosphorodithioate) from Cowarts sandy loam was studied in 1974 and 1975 to determine if runoff of this widely used chemical causes the pollution of streams and downstream areas. The studies were in a small agricultural watershed near Tifton, Georgia, that was instrumented to measure surface and subsurface flow. Significant differences occurred between years in both decomposition of ethoprop in the soil and its movement in the runoff water. Most of these differences are attributed to the formulation of ethoprop used. The movement of ethoprop in runoff water after injection of liquid ethoprop, stated as a percentage of the total amount applied, was 0.1% in surface runoff and 0.01% in subsurface runoff. From the granular formulation, 0.01% of the ethoprop moved in the surface water, but no subsurface flow occurred. Forced runoff from small plots produced ethoprop losses of 0.42% from the liquid formulation and 0.02% from the granular formulation. These data indicate that no hazard to the environment exists as a result of movement of ethoprop in surface or subsurface water. In excess of 90% of the ethoprop from either formulation was decomposed in the soil. (Moore-SRC)
W81-02965

CHANGES IN QUALITY OF GROUNDWATER IN THE LINCOLN AREA, MONTANA, 1974-79,
Geological Survey, Helena, MT. Water Resources Div.
R. B. Leonard, W. A. Wood, and A. J. Boettcher.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1108, November, 1980. 17 p, 5 Fig, 2 Tab, 6 Ref.

Descriptors: *Water quality, *Groundwater, *Water analysis, *Data collections, Water pollution sources, Waste water, Septic tanks, Wells, Water sampling, Bacteria, Nutrients, Drinking water, *Montana, *Lincoln.

Water samples from representative shallow wells in Lincoln, Mont., were collected in March and June 1979 for analysis to evaluate changes in quality since 1974-75 and possible contamination by domestic or agricultural waste. All samples were suitable for drinking water with respect to the constituents tested. Tests for fecal coliform bacteria were negative. The concentrations of dissolved solids, composed mainly of calcium, magnesium, bicarbonate, and sulfate, were less than 300 milligrams per liter. Concentrations of sodium, potassium, and chloride were 3.5 milligrams per liter or less. From March to June, the maximum concentration of nitrate plus nitrite nitrogen (as N) declined from 0.57 to 0.29 milligram per liter and the mean concentrations declined from 0.16 to 0.11 milligram per liter, probably as a result of dilution of ground water by snowmelt. The concentrations in samples from the same sites generally were lower in 1979 than in 1974-75. Isolation of sewage effluent in shallow zones by hardpan, consumption of nutrients by abundant phreatophytes, filtration of bacteria by the soil or aquifer, and dilution by underflow and recharge evidently combine to maintain the quality of the well waters within acceptable limits. (USGS)
W81-02976

QUALITY OF WATER IN THE TALLAHATCHIE RIVER NEAR NEW ALBANY, MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02986

QUALITY OF SURFACE WATER IN THE SUWANNEE RIVER BASIN, FLORIDA, AUGUST 1968 THROUGH DECEMBER 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. W. Hull, J. E. Dysart, and W. B. Mann, IV.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-206591, Price codes: A08 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-110, 1981. 97 p, 9 Fig, 8 Tab, 21 Ref.

Descriptors: *Water quality, *Streams, *Surface-groundwater relations, Water analysis, Springs, Sites, Data collections, Sampling, Trace elements, Water properties, Nutrients, Organic matter, Wetlands, Waste water, *Florida, *Suwannee River basin.

In the 9,950-square mile area of the Suwannee River basin in Florida and Georgia, 17 surface-water stations on 9 streams and several springs were sampled for selected water-quality properties and constituents from August 1968 through December 1977. Analyses from these samples indicate that: (1) the water quality of tributary wetlands controls the water quality of the upper Suwannee River headwaters; (2) groundwater substantially affects the water quality of the Suwannee River basin streams below these headquarters; (3) the water quality of the Suwannee River, and many of its tributaries, is determined by several factors and is not simply related to discharge; and (4) development in the Suwannee River basin has had observable effects on the quality of surface waters. (USGS)
W81-02992

COMPARISON OF THE PROPANE-AREA TRACER METHOD AND PREDICTIVE EQUATIONS FOR DETERMINATION OF STREAM-REAERATION COEFFICIENTS ON TWO SMALL STREAMS IN WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02995

A THEORETICAL ANALYSIS OF INTERFLOW OF WATER THROUGH SURFACE SOIL HORIZONS WITH IMPLICATIONS FOR MOVEMENT OF CHEMICALS IN FIELD RUNOFF,
Science and Education Administration, Durant, OK. Southern Plains Watershed and Water Quality Lab.
For primary bibliographic entry see Field 2G.
W81-03057

PRECIPITATION CHEMISTRY AND NUTRIENT LOADING BY PRECIPITATION IN A TROPICAL WATERSHED,
Colorado Univ. at Boulder. Dept. of Environmental, Population, and Organismic Biology.
W. M. Lewis, Jr.
Water Resources Research, Vol 17, No 1, p 169-181, February, 1981. 8 Fig, 5 Tab, 42 Ref.

Descriptors: *Precipitation(Atmospheric), *Particulate matter, *Nutrients, Lakes, *Tropical regions, Dry seasons, Air pollution, Lake Valencia, *Venezuela, Watersheds, Wet seasons, Nirogen compounds, Seasonal, Rain forests, Organic matter, Burning, Smoke, Inorganic compounds, Water pollution sources.

Loading rates of particulates, organic matter, and nutrients by atmospheric precipitation varied greatly with the season as measured during a two year study on the shores of Lake Valencia, Venezuela. This tropical region experiences an annual 100-day dry season during which extensive burning of vegetation is done. Total insoluble particulate matter loading totals 139 kg per hectare per year, of which 25% is organic and 75% inorganic.

During the dry season the insoluble particulates dramatically increase, and most of this is the inorganic fraction. Total loading rates for soluble cations are highest for Na, decreasing through the series Mg, Ca, H, NH4, and K. Bicarbonate has the highest loading rate among the soluble anions. Rates of loading decrease in the order chloride, sulfate, nitrate, and phosphate. Organic N and organic P account for major portions of the total N and P loading. Although loading rates of soluble materials are much higher during the wet season, soluble inorganic P, associated with inorganic particulates, peaks in the dry season. First rains bring very abrupt increases in most precipitation components, and as much as 15% of the total annual loading may occur within 1 or 2 weeks. (Cassar-FRC)
W81-03062

THE EFFECT OF SNOWMELT ON THE WATER QUALITY OF FILSON CREEK AND OMADAY LAKE, NORTHEASTERN MINNESOTA,
Geological Survey, Saint Paul, MN.
D. I. Siegel.
Water Resources Research, Vol 17, No 1, p 238-242, February, 1981. 7 Fig, 1 Tab, 23 Ref.

Descriptors: *Acidic waters, *Water quality, *Snowmelt, Path of pollutants, Sulfates, Sulfur compounds, Sulfides, Filson Creek, *Minnesota, Omaday Lake, Watersheds, Groundwater, Water pollution, Air pollution, Hydrogen ion concentration, Precipitation(Atmospheric), Base flow.

Sulfate concentrations and pH were studied in the Filson Creek, Minnesota, watershed to determine the source of sulfates in the surface waters. This area is poorly buffered and receives acid (less than pH 5.2) precipitation. Two weeks after the beginning of spring snowmelt, sulfate in the creek increased from 2 to 14 mg per liter and pH decreased from 6.6 to 5.5. During base flow sulfate did not appreciably increase from head waters to mouth of the creek. Mass balance calculations showed that groundwater did not contribute large amounts of sulfate to the creek. Discharge rate was low, 0.003 cu meters per sec, and sulfate concentrations were not sufficient to account for the rise in sulfate levels. Sulfate was apparently retained in the watershed (10.6 kg per hectare) during the study by reduction to sulfides and precipitation as metallic sulfides in wetlands and sorbed into the till. (Cassar-FRC)
W81-03068

STUDIES ON LAKE KINNERET (SEA OF GALILEE) WATERSHED. I. CHARACTERIZATION OF WATER AND SUSPENDED LOAD IN LAKE KINNERET TRIBUTARIES,
Technion-Israel Inst. of Tech., Haifa.
Y. Avnimelech.
Water, Air, and Soil Pollution, Vol 14, p 451-460, 1980. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Water quality, *Water pollution sources, *Nutrients, *Watersheds, *Israel, Lake Kinneret, Lakes, Hula Valley, Path of pollutants, Self-purification, Jordan River, Suspended load, Nitrogen compounds, Phosphorus compounds, Salinity.

A study of the water quality in the Lake Kinneret, Israel, watershed was done by sampling at seven sites, four in the Jordan River tributaries, two in the Jordan River, and one in the Mesoshim River where it enters the lake. The tributary water samples showed little influence from human activity, but in the Jordan itself, water quality parameters reflected the extensive agriculture, fish ponds, and human habitation in the Hula Valley. Electrolytes increased from 373 to 419 micro-mho between the Joseph and Huri bridges. Marked increases were also measured, in this stretch of the Jordan, in concentrations of ammonium compounds, suspended P, nitrates, Kjeldahl N, and suspended matter (from algal cells, not erosion). Between the Huri and Arik bridges the Jordan undergoes self-purification as it flows through a series of cascades which thoroughly mix and aerate the water. Bacterial action causes ammonium to decrease by half. Water quality in the Mesoshim River, which empties into Lake Kinneret near the Jordan, is similar to that in the Jordan tributaries and reflects the basaltic composition of the soil. (Cassar-FRC)
W81-03083

STUDIES ON LAKE KINNERET (SEA OF GALILEE) WATERSHED. II. NITRIFICATION AND SELF-PURIFICATION PROCESSES IN THE JORDAN CANYON,
Technion-Israel Inst. of Tech., Haifa.
Y. Avnimelech, M. Lacher, and A. Raveh.
Water, Air, and Soil Pollution, Vol 15, No 1, p 87-96, 1981. 3 Fig, 4 Tab, 5 Ref.

Descriptors: *Self-purification, *Jordan River, *Ammonium compounds, Nitrogen compounds, Phosphorus compounds, *Nitrification, Nutrients, Lake Kinneret, Rivers, Nitrates, Path of pollutants, Chemical reactions, Water quality, Water pollution, Algae, Aeration, *Israel.

The Jordan River canyon consists of a 15 km stretch immediately upstream of the Jordan River's inlet into Lake Kinneret. During passage throughthis section, in which the elevation changes from 60 meters above mean sea level to 209 meters below mean sea level, the shallow, turbulent water cascades over stones covered by an algal and microbial mat. Self-purification was studied in the field and in a laboratory model, with good agreement in results. During the 5 hours that the water flows through this stretch, ammonium dropped to 47% of its original level (0.101 mg per liter), Kjeldahl N to 90% of its initial level (1.58 mg per liter), and organic P to 72% of its original level (0.301 mg per liter). Nitrate increased downstream by an amount corresponding to the ammonium decrease. The reactions were described using first order kinetics, with rate constants as follows: ammonium, 0.15 per hour; organic N, 0.015 per hour; and organic P, 0.065 per hour. (Cassar-FRC)
W81-03084

TRANSFER OF METHYLMERCURY IN AN EXPERIMENTAL FRESHWATER TROPHIC CHAIN--TEMPERATURE EFFECTS,
Bordeaux Univ. (France). Lab. of Ecology and Animal Ecophysiology.
F. Ribeyre, A. Delarche, and A. Boudou.
Environmental Pollution (Series B), Vol 1, No 4, p 259-268, 1980. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Methylmercury, *Mercury, *Food chains, *Temperature, Path of pollutants, Ecosystems, Trophic level, Aquatic life, Aquatic animals, Water pollution, Algae, Livebearers, Rainbow trout, Trout, Chlorella, Daphnia, Fish, Freshwater fish.

Methylmercury bioaccumulation was studied in the laboratory using a 4-level aquatic trophic chain, consisting of Chlorella vulgaris (producer), Daphnia magna (primary consumer), Gambusia affinis (first rank carnivore), and Salmo gairdneri (second rank carnivore). Transfer of methylmercury was highest at 18C (1 pptm in the food and environment accumulated to 736 micrograms in the terminal consumer after 30 days) and less at lower and higher temperatures (330 micrograms at 10C and 230 micrograms at 26C). At 18C the rate of transfer from environment to terminal consumer was 15%. One purpose of this study was to develop a model for use as a contaminant test. (Cassar-FRC)
W81-03088

WATER POLLUTION RESULTING FROM A FIRE AT A TYRE DUMP,
Clyde River Purification Board, Glasgow (Scotland).
G. A. Best, and B. I. Brookes.
Environmental Pollution (Series B), Vol 2, No 1, p 59-67, January, 1981. 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Fishkills, *Chemical wastes, *Waste dumps, *Oily water, Pollutant identification, Path of pollutants, Aquatic life, Ultimate disposal, Industrial wastes, Tires, Rubber, Oil pollution, Disasters.

A worked-out limestone quarry used as a dump for 15,000 tons of used tires and unknown amounts of chemical wastes was the scene of a large fire in April 1978. Attempts to fight the fire produced a large volume of toxic, oily water which escaped into nearby streams, where complete elimination of aquatic life resulted. Concentrations of phenols and cyanide in water taken from streams within 2 days of the incident were 37-58 mg per liter and 4.1-7.1 mg per liter respectively. The oily material contained over 300 mg per liter phenolic substances. Cyanide could not be determined in the oily material because of chemical interference. Further chromatographic analysis of the oil showed about 200 different chemicals, including alkenes, alkanes, aromatic hydrocarbons and their derivatives, terpenes, phenolic compounds, ketones, alcohols, ethers, esters, benzothiazoles, pyridines, anilines, amines, amides, quinolines, and sulfur compounds. After a year of self purification and seasonal flooding, aquatic life had recovered. Analysis of a continuing oily leachate showed proportional increases in benzothiazoles and thiophenes and reduction of terpenes and ketones. (Cassar-FRC)
W81-03089

MANAGING THE COOLING CAPACITY OF THE UPPER RHINE: A CASE STUDY,
Chinese Academy of Science, Peking. Inst. of Environmental Chemistry.
W. K. H. Kinzelbach.
Environmental Management, Vol 5, No 1, p 69-77, January, 1981. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Mathematical models, *Thermal pollution, *Electric power plants, Rivers, Cooling water, Water pollution sources, Flow, Weather data, *Rhine River.

A one-dimensional temperature model of the Rhine River is evaluated for waste heat management purposes. A scheme is developed that allows a chain of power stations discharging into the same river to operate their cooling systems such that the total output of electricity is maximized and water temperature standards are accommodated. This optimal operation is derived using the river temperature model, a model of cooling tower behavior, and dynamic programming. A historical set of flow and weather data for three stations was used. Maximum electricity production can be achieved by using all the allowed temperature increases along the river. Optimal control was simulated for different standards regulating temperature increase. Real-time optimal control was judged not feasible because accuracy requirements for flow and weather data, which must be predicted two to three days in advance, are too high. (Small-FRC)
W81-03106

PLUTONIUM TRANSPORT TO AND DEPOSITION AND IMMOBILITY IN IRISH SEA INTERTIDAL SEDIMENTS,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
S. R. Aston, and D. A. Stanners.
Nature, Vol 289, No 5798, p 581-582, February 12, 1981. 2 Tab, 17 Ref.

Descriptors: *Plutonium, *Sediments, *Nuclear wastes, Path of pollutants, Water pollution sources, Sedimentation, *Irish Sea.

Plutonium levels in sediment cores collected from the intertidal reaches of a river and an estuary in the eastern Irish Sea 10 km south of Windscale, a nuclear fuel reprocessing plant, reflected discharges of waste over the 1970-1978 period with a 2-3 year lag time. Plutonium deposition is controlled by physical deposition of contaminated sediment particles. Vertical migration in the sediment after deposition was negligible. Chemical leaching of the sediment cores showed that 75-100% of the plutonium was contained in the non-detrital iron/manganese phases. The proportion of plutonium in these phases varied with depth, and there was no evidence for diagenetic changes in phase association after burial in the oxic sediment layer. (Cassar-FRC)
W81-03109

IMPORTANCE OF ORGANIC DEBRIS DAMS IN THE STRUCTURE AND FUNCTION OF STREAM ECOSYSTEMS,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. E. Bilby, and G. E. Likens.
Ecology, Vol 61, No 5, p 1107-1113, October, 1980. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Organic matter, *Barriers, *Ecosystems, Carbon cycle, Streams, Stream flow, Obstruction to flow, Sediment, Water properties, Organic carbon, *Natural levels, Organic debris dams.

A study was conducted at the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire to determine the role of organic debris dams in retaining organic matter within a small stream system. Removal of all organic matter from a section caused a significant increase in the organic carbon exported from this ecosystem. Dissolved organic carbon output increased 18%. Export of fine particulate organic carbon increased 632% and coarse particulate organic matter export increased 138%. Organic debris dams appeared extremely important in accumulating the organic debris. In first-order streams, debris dams contained nearly 75% of the standing stock or organic matter. In second-order streams the proportion of organic matter held by these dams dropped to 58% and to 20% in third-order streams. (Baker-FRC)
W81-03118

ALIPHATIC AND AROMATIC HYDROCARBONS IN BENTHIC INVERTEBRATES FROM TWO SITES IN ANTARCTICA,
British Antarctic Survey, Cambridge (England).
A. Clarke, and R. Law.
Marine Pollution Bulletin, Vol 12, No 1, p 10-14, January, 1981. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Antarctica, *Organic compounds, *Benthic fauna, Invertebrates, Hydrocarbons, Oil pollution, Path of pollutants, Water pollution, Fuels, King Edward Cove, Signy Island, Aromatic compounds, Marine animals.

Marine benthic invertebrates from a pristine site and an inhabited site on the Antarctic Coast were analyzed for concentration of aliphatic and aromatic hydrocarbons. Chromatograms of animals from King Edwards Cove, South Georgia, site of whaling operations, showed n-alkanes, naphthalene, phenanthrene, alkylated aromatics and a large unresolved complex mixture (total hydrocarbon range 85.5-815.6 ng per g). In contrast, chromatograms from animals in Signy Island, the uninhabited site, had fewer peaks and no unresolved complex mixture (total hydrocarbon range 10.1-22.8 ng per g). This paper suggests that hydrocarbons in the benthos are derived from local sources, not from world-wide dissemination of pyrolysis products of fossil fuels as described in a study of the area by Platt and Mackee, 1979. (Cassar-FRC)
W81-03119

METAL POLLUTANTS IN AGRICULTURAL SOILS AND THE ST. LOUIS URBAN RAINFALL ANOMALY,
Illinois State Water Survey, Urbana.
D. F. Gatz, J. Bartlett, and J. J. Hassett.
Water, Air, and Soil Pollution, Vol 15, No 1, p 61-75, 1981. 5 Fig, 6 Tab, 24 Ref.

Descriptors: *Metals, *Soil contamination, *Rainfall, Zinc, Cadmium, Lead, Heavy metals, Air pollution, *St. Louis area, Cities, Path of pollutants, Water pollution sources, Precipitation(Atmospheric), *Agricultural watersheds.

Concentrations of Zn, Cd, and Pb were determined in agricultural soils at 21 sites on two NE-SW transects downwind of St. Louis, Missouri, to evaluate the role of a rainfall anomaly in heavy metal deposition. During a 1971-1975 study, total summer rainfall northeast of the city was 15-30% greater than the area average. Highest concentrations in soils (micrograms in excess of background levels per 45 cm soil column with diameter of 1 cm) were Zn, 12,400; Cd, 109; and Pb, 2630, found at Granite City, Illinois, close to St. Louis. Metal levels decreased sharply with distance to 15 km from the city and then remained nearly constant. Even in the area of rainfall anomaly soil metal levels were only slightly elevated over background levels. Present atmospheric deposition rates did not account for the high levels of metals in the soil near Granite City. It is more likely that deposition from a Zn smelter which closed about 1960 caused the high levels. (Cassar-FRC)
W81-03144

EXTRACTABLE ORGANIC MATTER IN URBAN STORMWATER RUNOFF. I. TRANSPORT DYNAMICS AND MASS EMISSION RATES,
California Univ., Los Angeles. Dept. of Earth and Space Sciences.
R. P. Eganhouse, and I. R. Kaplan.
Environmental Science and Technology, Vol 15, No 3, p 310-315, March, 1981. 4 Fig, 4 Tab, 26 Ref.

Descriptors: Storm water, Urban areas, *Organic compounds, Los Angeles River, Oil pollution, Runoff, Water pollution sources, *Path of pollutants, Rivers, *Storm runoff, Surface waters, Organic matter, *Urban runoff.

Los Angeles River water was sampled during the second storm of the rainy season on Nov. 21, 1978, and analyzed for solvent-extractable organic substances. Five fractions, separated by thin layer chromatography, were isolated: total hydrocarbons, fatty acids, ketones, polar compounds, and nonelutable polar compounds. Measured organic parameters did not correlate with storm flow. However, most of the extractables were associated with particulate matter and partitioned between particulate and dissolved phases according to solubility. Extrapolation of results to the entire southern California drainage system gives 9,690 metric tons of total hydrocarbons entering the ocean annually, or 1% of the annual world petroleum hydrocarbon input via urban runoff. (Cassar-FRC)
W81-03156

WATER CHARACTERISTICS,
Missouri Univ., Kansas City.
G. D. Reed.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1117-1120, June, 1980. 30 Ref.

Descriptors: *Literature review, *Water properties, Water quality management, Water pollution control, *Water analysis, Water quality.

A literature review is presented of articles dealing with water characteristics which were published during 1979. Studies conducted included testing rainwater for acidity, determining the major ion concentrations in lakes in southern Norway, and determining the acidity of snow and rain in the Black Forest. Glass electrodes were tested for their suitability for measuring pH in ammonia-dosed boiler feed water, and a model was evaluated for the description of pH-related parameters in an impoundment. Sediment studies were also performed, as were lake water quality studies. The anaerobic degradation process was the topic of several studies. Evidence was presented against the general hypothesis that the redox potential of an organic pollutant alone controls its ability to degrade anaerobically. A literature review by Brannon showed that the highly reduced conditions reached by anaerobic systems containing substantial amounts of organic matter appeared to involve mixed potentials of organic oxidation-reduction couples. (Small-FRC)
W81-03162

URBAN RUNOFF AND COMBINED SEWER OVERFLOW,
Environmental Protection Agency, Edison, NJ.
R. Field, and C. Cibik.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1290-1307, June, 1980. 150 Ref.

Descriptors: *Urban runoff, *Combined sewer overflows, *Sewer systems, Sewers, Urban drainage, Urban hydrology, Hydrology, Drainage, Disinfection, Model studies, Management, *Literature review.

Recent research in the area of urban runoff and sewer overflow is cited for brief review. Rainfall runoff quality data were gathered from 47 catchments in 25 cities and assembled on a storm event basis to study the characteristics of storm runoff and its effects. Indicator bacteria and pathogens were taken from waste water, urban streams and stormwater in another study conducted in Baltimore, Md. Quality of urban runoff was also studied in Burlington, Canada; Northern Guam; Durban, South Africa; Denver, Colorado; the Delaware River; and Berkeley Hills, California. The development of urban hydrology was reviewed in several areas. The understanding of the impact of pollutants on receiving waters was enlarged through several research projects including ones in Knoxville, Tennessee; Lodi, New Jersey; Los Angeles; Newark, Delaware; Hawaii; San Jose, California, and additional sites. Urban stormwater runoff studies using transient flow models were used to study proper management of runoff events. Control of combined sewer overflows was examined from the viewpoint of source controls, collection system controls, and off-line storage and treatment. Studies also dealt with the treatment and disinfection of stormwater runoff and combined sewer overflows. (Baker-FRC)
W81-03176

BIOACCUMULATION AND BIOAMPLIFICATION OF MERCURY DERIVATIVES BY A TERTIARY CONSUMER: SALMO GAIRDNERI - TEMPERATURE EFFECTS. (BIOACCUMULATION ET BIOAMPLIFICATION DES DERIVES DU MERCURE PAR UN CONSOMMATEUR DE TROISIEME ORDRE: SALMO GAIRDNERI - INCIDENCES DU FACTEUR TEMPERATURE),
Bordeaux-1 Univ., Talence (France). Lab. d'Ecologie Animale.
For primary bibliographic entry see Field 5C.
W81-03191

RAINFALL INPUT OF TOXAPHENE TO A SOUTH CAROLINA ESTUARY,
South Carolina Univ., Columbia. Dept. of Chemistry.
H. W. Harder, E. C. Christensen, J. R. Matthews, and T. F. Bidleman.
Estuaries, Vol 3, No 2, p 142-147, June, 1980. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Estuaries, *Toxaphene, *Rainfall, Precipitation(Atmospheric), *Insecticides, South Carolina, Pesticide residues, Polychlorinated biphenyls, DDT, Pollutants, Water pollution, Air pollution, Chlorinated hydrocarbon pesticides, Path of pollutants.

Toxaphene in rainfall over a South Carolina salt marsh increased from background levels to variable high levels (12-497, mean 157 ng per kg) in July and August, the season of heaviest agricultural use. Mean concentration of polychlorinated biphenyls was 7.5 ng per kg; DDT, 1.4 ng per kg; and DDE, 0.5 ng per kg. Airborne toxaphene concentrations ranged from 0.33-7.2 ng per kg air. Estimated rainfall input of toxaphene during June-September 1977 for the 26 sq km North Inlet estuary was 1.2 kg. Separate experiments showed that dry deposition of toxaphene accounted for less than 15% of the total. (Cassar-FRC)
W81-03193

NITROGEN BALANCE IN SMALL RIVER BASINS UNDER AGRICULTURAL AND FORESTRY USE,
Akademiya Nauk SSSR, Pushchino. Inst. of Agrochemistry and Soil Sciences.
V. N. Kudeyarov, and V. N. Bashkin.
Water, Air, and Soil Pollution, Vol 14, No 1, p 23-27, 1980. 3 Tab, 5 Ref.

Descriptors: *Nitrogen cycle, *Fertilizers, *River basins, *Agriculture, *Forests, Water pollution ef-

fects, Water pollution sources, Nitrogen compounds, Watersheds(Basins), *Russia, Tadenka River, Skniga River, Nitrates, Ammonium compounds, Path of pollutants.

Two small river basins in Russia, one forested and one agricultural, with identical soils and climatic conditions were used in a comparison of nitrogen balances. In the forested Tadenka River basin, nitrogen balance was practically compensated (inflow 76,000 kg per year, outflow 75,000 kg per year). The water contained no ammonium compounds; nitrate and organic N was less than 0.5 mg per liter. The intensely farmed Skniga River basin had 2746 tons N input and 2315 tons output in 1977. Of the total input, 77.3% was from chemical fertilizers. Surface and groundwater losses were 20.7%. Mean annual concentration of total N in surface water was 3.5 mg per liter, nitrate-N 2.1 mg per liter. Before farming began in this area in 1967, N balance was -12.2 kg per hectare. It was +15.5 kg per hectare in 1977. Groundwater N increased from 0.8 to 6.5 mg per liter over the 10 year period. (Cassar-FRC)
W81-03199

THE ABSORPTION OF TRITIUM GAS BY ENGLISH SOILS, PLANTS AND THE SEA,
Atomic Energy Research Establishment, Harwell (England).
J. A. Garland, and L. C. Cox.
Water, Air, and Soil Pollution, Vol 14, p 103-114, 1980. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Tritium, *Absorption, *Plant physiology, *Soil physical properties, Path of pollutants, Radioisotopes, *England, *Sea water, Air pollution.

Absorption of tritium gas, released to the atmosphere from light sources and nuclear reactors, was measured in soils, plants, and sea water in southern England. Deposition velocity of the soil absorption process ranged from 0.01 to 0.1 cm per sec. Soil temperature and type had less effect on the process than did the season of the year, with the maximum values in late summer and early fall and minimum values in winter and spring. The sea surface, distilled water, and vegetation proved to be negligible sinks for tritium gas. The dose of tritium gas to persons living close to an emission source was calculated to be 1/8 of that produced by an equal release of tritiated water vapor. The rate of destruction by the soil surface was sufficient to account for the lifetime of tritium in the atmosphere, estimated from hemisphere budget considerations. (Cassar-FRC)
W81-03204

THE EFFECT OF PH ON THE RETENTION OF CU, PB, ZN AND CD BY CLAY-HUMIC ACID MIXTURES,
Newcastle Univ. (Australia). Dept. of Chemistry.
D. Hatton, and W. F. Pickering.
Water, Air, and Soil Pollution, Vol 14, p 13-21, 1980. 4 Fig, 25 Ref.

Descriptors: *Heavy metals, *Humic acids, *Chelation, *Organic acids, *Aquatic systems, Copper, Lead, Zinc, Cadmium, Tannic acid, Clays, Organic matter, Chemical reactions, Path of pollutants, Hydrogen ion concentration, Adsorption.

The amount of metal ions (Cu, Pb, Zn, and Cd) sorbed by clay-humic acid mixtures increased with increasing pH over the range 3-6. When clay-cellulose or illite-humic acid samples were used as adsorbents, uptake of metal ions was additive. However, when humic acid and Na(+) form clays were used, adsorption was reduced, especially in the case of Cu and Zn, because of component interactions. Organic acids dominated the adsorption process in acidic media, but in pH 6-7 virtually all the metal ion was retained by the clay. This process was in competition with the ability of the organic matter to form soluble metal humates. When tannic acid was substituted for humic acid, the 4 metal ions formed compounds of limited solubility over a certain pH range (4.5 for Cu and 7 for Cd). (Cassar-FRC)
W81-03205

FLUORIDE DISTRIBUTION AND DISPERSION PROCESSES ABOUT AN INDUSTRIAL POINT SOURCE IN A FORESTED COASTAL ZONE,
Victoria Univ. (British Columbia). Dept. of Chemistry.
M. B. Hocking, D. Hocking, and T. A. Smyth.
Water, Air, and Soil Pollution, Vol 14, p 133-157, 1980. 3 Fig, 10 Tab, 58 Ref.

Descriptors: *Fluorides, *Smelters, *Air pollution, *Path of pollutants, Forest soils, Water pollution sources, Soil contamination, Aluminum smelters, Marine animals, Coasts, Industrial wastes, Metallurgy.

Fluoride concentrations of air, water, soil, vegetation, and marine samples were measured in the vicinity of an aluminum smelter at Kitimat, British Columbia. Ambient air fluoride concentrations varied widely, depending on wind speed and direction and variations in smelter operating conditions. Rainfall had no apparent correlation with fluoride concentrations. F levels in surface waters were not related to wind, precipitation, or smelter discharge rates, but a creek closest to the smelter showed generally higher levels. Marine water analyses indicated a localized F rich surface layer; bottom sediments were not F enriched. Surface soil F concentrations were high near the smelter and decreased with distance. Moss samples contained high levels of F, up to 9.2 micrograms per g in dry samples. Western hemlock foliage contained more F in older leaves than in newer leaves, and more at the top of the tree than at the bottom. F levels in marine plants and animals indicated that dispersion in the marine environment was less than in the atmosphere. Bivalves and barnacles contained very low quantities of F, and amphipods, very high quantities. (Cassar-FRC)
W81-03206

INFLUENCE OF HUMATE-SOLUTE INTERACTIONS ON AQUEOUS HEAVY METAL ION LEVELS,
Newcastle Univ. (Australia), Dept. of Chemistry.
A. Beveridge, and W. F. Pickering.
Water, Air, and Soil Pollution, Vol 14, p 171-185, 1980. 1 Fig, 6 Tab, 28 Ref.

Descriptors: *Heavy metals, *Humic acids, *Chelation, Solubility, Organic matter, Copper, Lead, Zinc, Cadmium, Metals, *Hydrogen ion concentration, Water pollution control.

Removal of heavy metal ions (Cu, Pb, Zn, and Cd) from aqueous solution by humic acid suspensions depended on several factors. As the pH of the solution increased, the amount of metal ion adsorbed increased until the threshold value required for partial dissolution of the solid and formation of soluble metal humates was exceeded. The pH of maximum absorption varied with the metal ion (Pb and Cu, pH 5.8-7.6, and Cd and Zn, pH 6.0-8.0) and the character of the humic acid. The heavy metals were adsorbed at lower pH and to a greater degree than Mg and Ca. The presence of other ligands, some of which are present in waste waters or are derived from plant metabolism (EDTA, nitrilotriacetic acid, citrate, glycine, cysteine, oxalate, tartrate, ethylenediamine bipyridyl) affected the pH of maximum adsorption, generally increasing the final solution levels. (Cassar-FRC)
W81-03211

DISTRIBUTION AND ECOLOGY OF MARINE FUNGI IN SIERRA LEONE (TROPICAL WEST AFRICA),
Alexandria Univ. (Egypt). Dept. of Oceanography.
A. A. Aleem.
Botanica Marina, Vol 23, No 11, p 679-688, November, 1980. 6 Fig, 7 Tab, 31 Ref.

Descriptors: *Marine fungi, *Ecology, Distribution patterns, Tropical regions, Climatology, Mangrove swamps, Fungi, Microorganisms, Sierra Leone, West Africa, Ocean currents, *Africa.

The distribution and seasonal variations of higher marine fungi along the coasts of Sierra Leone were studied with particular reference to the mangrove habitat. Twenty-seven different species were identified, comprising three Phycomycetes, 14 Ascomycetes and 10 Deuteromycetes. The mangrove mycota displayed a seasonal periodicity, increasing in number of species and growth intensity during the wet season. No distinct vertical zonation was noted in the lignicolous fungi which inhabited the mangrove. A comparison was made between the geographical distribution of the higher marine fungi under consideration and those on the other side of the Atlantic Ocean as well as in the Pacific and Indian Oceans. The close affinity found between Eastern and Western Atlantic mycota could be explained by the current gyres to the north and south of the equator and their role in transporting mangrove seeds, wood and associated fungi between the African and American coastlines. (Baker-FRC)
W81-03214

A REVIEW OF WATER QUALITY PROBLEMS CAUSED BY VARIOUS OPEN DISTRIBUTION STORAGE RESERVOIRS,
Keyes Associates, Providence, RI.
J. J. Morra.
Journal of the New England Water Works Association, Vol 94, No 4, p 316-321, 1980. 4 Ref.

Descriptors: *Drinking water, *Storage reservoirs, Reservoir management, *Water pollution sources, Water quality, Public health, Reviews, Evaluation.

Contamination of finished water contained in open storage is discussed. Uncovered tanks and reservoirs can be contaminated by airborne contaminants such as industrial pollutants and contaminants transported by surface water runoff. There can also be groundwater contaminants, and chemical reactions in the reservoir can cause contamination of the drinking water. Animal and bird droppings are a possible source of bacterial contamination, and algae or other aquatic organisms can cause problems. Water quality problems in a New England open distribution storage reservoir with a 112 mg capacity were found to be caused by roosting herring gulls that visited the reservoir after dining at a nearby landfill. Most studies of open reservoirs show no increase or decrease in water quality associated with open storage, but the potential for contamination is generally recognized. All new finished water reservoirs must be covered. Existing open reservoirs can be covered, and the economic justification for covering is a function of size, setting, and the real or probable threat to public health posed by the facility. (Small-FRC)
W81-03218

5C. Effects Of Pollution

EFFECTS OF HERBICIDE USAGE ON WATER QUALITY OF SELECTED STREAMS IN WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
D. L. Butler.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.25 in paper copy, $5.50 in microfiche. Geological Survey Open-File Report 80-1110, December, 1980. 17 p, 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Water quality, *Herbicides, Weed control, *Water pollution effects, *Streams, Water sampling, Sites, Data collections, Water analysis, Bottom sampling, Pesticide residues, *Wyoming, North Platte River.

During 1977 and 1978 the Wyoming Department of Agriculture, in conjunction with county weed and pest control districts, conducted a noxious-weed-control program in Wyoming. The herbicides primarily used were picloram, 2,4-D, and dicamba. The U.S. Geological Survey, in cooperation with the Wyoming Department of Agriculture, sampled and analyzed water from selected streams for these herbicides plus silvex; 2,4,5-T; and 2,4-DP. This report contains data for samples collected during 1977 and 1978. The most commonly detected herbicides in water samples were

2,4-D with 41% nonzero values and picloram with 34.5% nonzero values. Herbicide occurrence in bottom-material samples was uncommon; dicamba was found with 9% nonzero values. The maximum herbicide concentration in water was 1.1 micrograms per liter of 2,4-D, and the maximum herbicide concentration in bottom material was 8.0 micrograms per kilogram of 2,4-D. Based on available toxicity data and water-quality criteria, these herbicide concentrations do not constitute dangerous or harmful concentrations to humans or to the environment. (USGS)
W81-02924

PREIMPOUNDMENT WATER QUALITY OF THE WILD RICE RIVER, NORMAN COUNTY, MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
L. H. Tornes.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A095542, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-79, 1980. 36 p, 16 Fig, 3 Tab, 24 Ref.

Descriptors: *Water quality, *Preimpoundment, *Multipurpose reservoirs, Water sampling, *Baseline studies, Sites, Data collections, Water properties, Water analysis, Water pollution effects, Pesticides, Bacteria, Nutrients, Phytoplankton, *Minnesota, *Wild Rice River(MN), *Norman County(MN).

Water samples have been collected at two sites on the Wild Rice River since September 1974 to establish baseline water-quality characteristics before construction of a reservoir for recreation and flood control near Twin Valley, Minn. A decline in water quality between the sites is shown by mean total phosphorus concentrations, which increase from 0.06 to 0.10 milligram per liter downstream, and mean turbidity, which increases from 12 to 24 units downstream. Phosphorus and ammonia concentrations, as high as 0.31 and 2.7 milligrams per liter, respectively, could be the result of domestic waste input to the river upstream from Hendrum. Biochemical oxygen demand concentrations were significantly higher during spring runoff than during the rest of the year. Four out of 90 bacteria samples taken at Twin Valley indicate the presence of human fecal material, though bacteria densities do not exceed recommendations of the U.S. Environmental Protection Agency for public-water supplies. The dominace of organic-pollution tolerant phytoplankton in 49 out of 78 samples also indicates degradation of the river quality at Twin Valley. Nutrient concentrations at Twin Valley have no apparent effect on phytoplankton concentrations. None of the consitituents sampled were found to exceed recommended concentrations for public-water supplies. (USGS)
W81-02931

EFFECTS OF WASTE WATER SPRAY IRRIGATION ON IDIGENOUS MOSQUITO POPULATIONS,
Michigan State Univ., East Lansing. Dept. of Entomology.
M. Zaim, and H. D. Newson.
Environmental Entomology, Vol 9, No 5, p 563-566, October, 1980. 1 Fig, 1 Tab, 11 Ref. OWRT-B-040-MICH(2).

Descriptors: *Spray irrigation, *Mosquitoes, *Aquatic populations, *Waste water farming, *Water pollution effects, Environmental effects, Spraying, Irrigation, Direct irrigation, Sprays, Aquatic insects, Populations, Farming, Broad irrigation, Waste water disposal, Waste water management, Waste water pollution, Waste water renovation, Water reuse, Pollution load, Population exposure.

The objectives of this study were to determine the effects of prolonged waste water irrigation on the diversity of mosquito species in a spray area, and the potential for the enhancement of insect-borne diseases resulting from such operations. The study location was a beech-maple climax forest of about 18 ha. located in the spray irrigation portion of the Water Quality Management Project site at Michigan State University. Waste water effluent from the East Lansing secondary sewage treatment facility is piped to the site, a pond-marsh-terrestrial spray complex covering about 200 ha., and consisting of four interconnected man-made ponds. Four consecutive years of municipal sewage disposal by spray irrigation produced marked changes in the populations and species composition of the mosquitoes present. It appears likely that it will be several more years before species composition and population densities become stabilized. Observations indicate that sewage effluent disposal by spray irrigation creates a diversity of excellent mosquito breeding habitats and results in increased population and species diversity that enhance the potential for pest and disease transmission problems. Appropriate safeguards need to be incorporated in the design/operation of these types of sewage disposal systems. (Zielinski-IPA)
W81-02934

ALGAL BIOASSAYS WITH LEACHATES AND DISTILLATES FROM WESTERN COAL,
Minnesota Univ., Duluth. Lake Superior Basin Studies Center.
D. Z. Gerhart, J. E. Richter, S. J. Curran, and T. E. Robertson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-205834, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-051, May, 1980. 77 p, 34 Fig, 11 Tab, 37 Ref. R803932.

Descriptors: *Algae, *Coal, *Runoff, *Water pollution effects, Bioassay, Leachates, Coal storage, Organic compounds, Zooplankton, Species composition, Ecosystems, Algal growth, Aquatic environment, Bacteria.

Increasing reliance on the use of low-sulfur western coal as an energy source will necessarily involve the shipment and storage of extremely large quantities of this fuel. Runoff from coal storage areas may enter receiving bodies of water, and spontaneous heating within coal storage piles may release volatile organic compounds which eventually enter the aquatic environment. In order to assess the effects of these materials on the aquatic environment, and specifically on freshwater algae, three types of bioassays were conducted using coal leachates and distillates prepared in the laboratory. Periphyton communities growing on artifical substrates in a laboratory stream facility generally showed stimulation of growth and some species composition changes in response to leachate concentrations of 3% and higher. Concentrations of 15-20% distillate inhibited the growth of stream periphyton. Short-term laboratory bottle tests with species of algae generally showed growth inhibition with leachate and distillate concentrations of 5-20%. However, when distillates were bubbled to remove volatile organic compounds, growth stimulation frequently was observed. Increases in algal biomass and bacterial populations were observed in three in situ experiments with distillates in a small lake. Although nearly all zooplankters were killed at distillate concentrations of 20%, reduced zooplankton grazing was probably not the cause of the observed increases in algal biomass. (Moore-SRC)
W81-02937

LONG-TERM EFFECTS OF THE BARGE FLORIDA OIL SPILL,
Woods Hole Oceanographic Institution, MA.
H. L. Sanders, J. F. Grassle, G. R. Hampson, L. S. Morse, and S. Garner-Price.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-144792, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-012, January, 1981. 3 p, 3 Fig.

Descriptors: *Oil spills, *Water pollution effects, *Estuarine environment, Marine environment, Benthos, Mortality, Aquatic animals, Fish, Aquatic plants, Hydrocarbons, Toxicity, Crustaceans, Birds, Intertidal areas, *Ecological effects.

Intensive sampling of marine and estuarine benthos was conducted over a 5-year period after a spill of No 2 fuel oil by the barge Florida off West Falmouth, Massachusetts, on September 16, 1969. Samples were taken along an onshore-offshore gradient of pollution, and control samples were taken from unoiled sites. Analyses of hydrocarbons established that pollution was greatest and most persitent in the intertidal and subtidal zones of Wild Harbor River and less severe in degree and duration at stations farthest from shore. A variety of concurrent analyses showed that disturbance of the fauna was most severe and longest lasting at the most heavily oiled sites and less severe but perceptible at lightly oiled stations. Patterns of disturbance were not related to granulometry of the sediments. Plants, crustaceans, fish, and birds suffered both high mortality immediately after the spill, and physiological and behavioral abnormalities directly related to high concentrations of the fuel oil. Five years after the spill, its effects on the biota were still detectable, and partly degraded No 2 fuel oil was still present in the sediments in Wild Harbor River and estuary. (Author's abstract)
W81-02938

SUBLETHAL EFFECTS OF TOXAPHENE ON DAPHNIDS, SCUDS, AND MIDGES,
Fish and Wildlife Service, Columbia, MO. Fish-Pesticide Research Lab.
H. O. Sanders.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153554, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-006, January, 1980. 24 p, 3 Tab, 29 Ref. EPA-IAG-141(D).

Descriptors: *Aquatic animals, *Invertebrates, *Pesticide toxicity, *Daphnia, *Midges, Growth, Life cycles, Pesticide residues, Bioaccumulation, Bioindicators, Pollutants, Toxicity, Chlorinated hydrocarbons.

Toxaphene enters the aquatic environment as a result of its use as a pesticide, but little is known of its chronic effects on aquatic invertebrates. Daphnids (Daphnia magna), scruds(Gammarus pseudolimnaeus), and midge larvae (Chironomus plumosus) were continuously exposed to toxaphene in a flow-through system. Exposure of daphnids for a complete life cycle (21 days) to 0.12, 0.28, 0.54, and 1.0 microgram per liter of toxaphene significantly ($P<0.05$) reduced production of young; the no-effect concentration was 0.07 microgram per liter. Toxaphene concentrations of 0.25 microgram per liter and greater significantly ($P<0.05$) reduced growth of scuds and concentrations of 3.2 microgram per liter and greater significantly ($P<0.05$) reduced emergence of midges. The no-effect concentrations were 0.13 microgram per liter for growth of scuds and 1.0 microgram per liter for emergence of midges. Daphnids continuously exposed to toxaphene accumulated residues after 7 days that were 4,000 times (based on organism wet weight) the water concentration of 0.06 microgram per liter. Whole body residues in midge larvae were below the minimum detection limit of 0.1 microgram per liter. Maximum acceptable toxicant concentrations (MATC) of toxaphene for the three species of aquatic invertebrates were estimated using reproduction of daphnids, growth of scuds, and emergence of midges as indicators of toxic effects. The MATC was estimated to be between 0.07 and 0.12 microgram per liter for daphnids, between 0.13 and 0.25 microgram per liter for scuds, and between 1.0 and 3.2 microgram per liter for midges. (Brambley-SRC)
W81-02947

ACUTE TOXICITY OF TOXAPHENE TO FATHEAD MINNOWS, CHANNEL CATFISH, AND BLUEGILLS,
Fish and Wildlife Service, Columbia, MO. Fish-Pesticide Research Lab.
W. W. Johnson, and A. M. Julin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152796, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-005, January, 1980. 29 p, 3 Fig, 4 Tab, 44 Ref. EPA-IAG-141(D).

Descriptors: *Pesticide toxicity, *Fish, *Survival, *Mortality, Water pollution, Environmental effects, Hardness, Hydrogen ion concentration, Water temperature, Life cycles, Toxicity, Bluegills, Catfish, Fathead minnows.

Toxaphene is becoming a more common pollutant in the aquatic environment, thereby increasing the liklihood of its occurrence in diverse habitats and during different stages of a fish's life cycle. Toxaphene was very toxic to fathead minnows (Pimephales promelas), channel catfish (Ictalurus punctatus), and bluegills (Lepomis macrochirus) in static tests; 96-h LC50's ranged from 2.6 to 20 microgram per liter at 20C. Fathead minnows were the least susceptible and bluegill and channel catfish were about equal in susceptibility. Prolonged exposures of 12 to 34 days in flow-through tests produced time-independent LC50 values of 0.6 to 1.9 microgram per liter, significantly lower than the 96-h values. The toxicity of toxaphene was not influenced by variations in pH or water hardness in static tests. Temperature seemed to influence rate of onset rather than degree of response. Toxicities were similar at 20 and 25C inflow-through tests, however, a decrease in the time required for mortality to become asymptotic with time was observed. Time-independence was reached after 7 to 16 days of exposure at 25C while 24 to 34 days were required at 20C. The life stage of channel catfish most sensitive to toxaphene poisoning was the swim-up fry with a 96-h LC50 of 0.8 microgram per liter. Early yolk sac fry were extremely resistant with a 24-h LC50 of 4.7 mg/l, however, within 96 hours the yolk had absorbed and the LC50 had declined to 8.0 microgram per liter. (Brambley-SRC)
W81-02948

INFLUENCE OF ADVANCED WASTE WATER TREATMENT ON THE FISHERY RESOURCE OF SHAGAWA LAKE, MINNESOTA,
Wisconsin Univ.-Superior. Dept. of Biology.
W. A. Swenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-182496, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-036, March, 1980. 93 p, 11 Fig, 30 Tab, 64 Ref, 1 Append. R-803673.

Descriptors: *Phosphorus removal, *Water pollution control, *Fish populations, *Trophic level, *Waste water treatment, Pike, Perch, Herring, Walleye, Dissolve oxygen, Macrophytes, Zooplankton, Model studies, Cycling nutrients, *Shagawa Lake, Minnesota.

Changes in the warmwater fish populations in Shagawa Lake, Minnesota were measured in response to the altered trophic conditions brought about by phosphate removal from sewage discharges entering the lake. Abundance, distribution, growth and feeding interrelationships of walleye (Stizostedion vitreum vitreum), northern pike (Esox lucius), yellow perch (Perca flavescens), and lake herring (Coregonus artedii) were determined in relation to changes in prey density; chlorophyll a concentration; oxygen concentration; and macrophyte abundance. A conceptual model based on the 'niche concept' was developed to identify the influence of changes in various parts of the system on individual fish populations and on the total fish species complex. Recycling of nutrients slowed the response of the system to the restoration program. Zooplankton density was not altered significantly, and hypolimnetic oxygen remained low throughout the three year period of study following the initiation of phosphate removal. Transparency and abundance of macrophytes increased. The field data and the model suggest that production of walleye is being reduced by these factors which restrict their feeding and distribution. They also promote increased cannibalism and northern pike predation. Growth and production of yellow perch and lake herring appear to be limited by some of the factors which control walleye production, and by apparent changes in the zooplankton assemblage. The 'niche' and production of the northern pike population is expanding in response to changes in several feeding-related 'niche dimensions'. (Brambley-SRC)
W81-02951

GEOLOGICAL AND HYDROCHEMICAL SENSITIVITY OF THE EASTERN UNITED STATES TO ACID PRECIPITATION,
Brookhaven National Lab., Upton, NY.
For primary bibliographic entry see Field 5B.
W81-02952

EFFECTS OF ACID PRECIPITATION ON SOIL LEACHATE QUALITY, COMPUTER CALCULATIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W81-02954

FRESHWATER MICRO-ECOSYSTEM DEVELOPMENT AND TESTING OF SUBSTITUTE CHEMICALS,
Environmental Protection Agency, Beltsville, MD. Pesticide Degradation Lab.
A. R. Isensee, and R. S. Yockim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151533, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-008, January, 1980. 37 p, 4 Fig, 13 Tab, 2 Ref. EPA-IA6-05-5811.

Descriptors: *Ecosystems, *Model studies, *Toxicity, *Testing procedures, *Pesticides, Aquatic animals, Aquatic plants, Degradation, Water pollution sources, Pollutants, Organic compounds.

To develop additional and better techniques for studying pesticides in aquatic model ecosystems, a model ecosystem was designed and built that utilizes the continuous dosing, flow-through system routinely used for chronic fish toxicity testing in combination with the organisms used in static model ecosystem testing. A previously developed recirculating static model ecosystem was simultaneously used with the flowing water system to test the behavior of pentachloronitrobenzene (PCNB), simazine, and trifluralin. Pesticides were introduced to the static system at ranges of 0.1-100 ppm and at 0.1-100 ppb in the flowing system and the effects were observed on Daphnia magna, Oedogonium cardiacum, Helisoma sp., and Gambusia affinis. The results indicate that both models are valuable tools for determining the fate and behavior of pesticides in the aquatic environment, but cannot be routinely substituted for each other. The static model system simulates a sediment or erosional pesticide source and provides conditions for chemical and biological degradation, while the flowing-water model system simulates an effluent pesticide source and provides continuous chemical exposure to the organisms. Trifluralin which is rapidly degraded was accumulated to a high level in the flowing system, but degraded and so not accumulated in the static system, whereas there was little difference between the systems for the long-lasting pesticides. If the compound is reasonably degradable the flowing system will give the most reliable information, but either system will give good results for the less degradable compounds. (Brambley-SRC)
W81-02956

PROBABLE EFFECTS OF ACID PRECIPITATION ON PENNSYLVANIA WATERS,
Pennsylvania Cooperative Fishery Research Unit, University Park.
D. E. Arnold, R. W. Light, and V. J. Dymond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-132004, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-012, January, 1980. 28 p, 3 Fig, 5 Tab, 17 Ref. B0835NAEX.

Descriptors: *Acid rain, Alkalinity, *Hydrogen ion concentration, *Ecological effects, *Fish populations, Chemical properties, Physiographic provinces, Streams, Growth, Species diversity, Water pollution effects.

In order to identify any trends in water chemistry and fish communities in Pennsylvania waters which would indicate that acid precipitation was affecting them adversely, five existing data bases were examined for the existence of water analyses from the same or nearby locations, separated by at least one year. Of 983 analysis reports, there were 314 cases with two or more such points. Of these 107 or 34% showed a decrease in pH, alkalinity, or both. The average decrease in pH was 0.4 units, with a maximum of 1.3 units. The average decrease in alkalinity was 15.1 mg/l (as calcium carbonate) with a maximum of 105 mg/l. The average time span between the earliest and latest sample was 8.5 yr. When the data were separated by physiographic provinces, it became apparent that although the majority of the decreases occurred in the streams on the relatively insoluble rocks of the Allegheny Plateau, there were also many cases in the ridge-and-valley province and other regions. Many of these decreases are to pH levels considered marginal for growth and reproduction of trout and other fishes. Seventy-one of the 107 analyses showing decreased pH or alkalinity included fish collection data. In 40 of these cases (58%), the number of fish species present decreased as well. (Brambley-SRC)
W81-02957

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING, PART V - AGE AND GROWTH OF WALLEYES AND SAUGERS IN THE TONGUE RIVER RESERVOIR, MONTANA, 1975-77,
Montana Cooperative Fishery Research Unit, Bozeman.
V. L. Riggs, and R. W. Gregory.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-186521, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-038, March, 1980. 63 p, 16 Fig, 15 Tab, 35 Ref. R803950.

Descriptors: *Fish populations, *Coal mines, *Reservoirs, *Strip mine wastes, Spawning, *Ecological effects, Water pollution sources, Life cycles, Environmental effects, Growth, Mine wastes, *Tongue River Reservoir, Montana.

A study was conducted between 1975-1977 on the populations of walleye (Stizostedion vitreum) and sauger (Stizostedion canadense) in the Tongue River Reservoir, in southeastern Montana. The Tongue River Reservoir is the recipient of mine water effluents from the Decker Mine, the largest surface coal mine in the western United States. The objective of the study was to determine possible impacts of the mine on the walleye and sauger populations in the reservoir, and to provide data against which future comparisons can be made. These species were chosen because they are two of the most important game fishes in the reservoir. The age and growth of 640 walleyes and 546 saugers were determined from collections made in gill nets, trap nets, and by electrofishing. The 1973 sauger year class and the 1972 walleye year class dominated the catches during the three years of the study. The movements of tagged fish in late March and early April 1977 strongly suggested that walleyes spawned in the Tongue River, upstream from the reservoir. The growth rates for both species were excellent for a northern latitude reservoir, indicating no noticeable effect by surface coal mine operations at the time of the study. (Author's abstract)
W81-02958

EPIDEMIOLOGIC STUDIES OF VIRUS TRANSMISSION IN SWIMMING WATERS,
Wisconsin Univ.-Madison.
D. J. D'Alessio, T. E. Minor, D. B. Nelson, C. I. Allen, and A. A. Tsiatis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-159676, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/1-80-006, January, 1980. 73 p, 26 Tab, 25 Ref, 3 Append. R-804161.

Descriptors: *Viruses, *Swimming, *Swimming pools, Beaches, *Enteroviruses, *Human diseases, Recreation facilities, Epidemiology, Statistical analysis, Infection, Public health.

Retrospective and prospective epidemiologic studies were conducted to determine if swimming activities increase the risk of acquiring enteroviral infection in children. The retrospective study consisted of a surveillance of recent swimming activities and clinical histories in 3,774 children who visited a pediatric clinic over a period of 2 years. A highly statistically significant increased rate of swimming activity was found among children from birth to 15 years who had enterovirus associated illnesses as compared to the well controls. The prospective study examined the relationship between swimming activities and enteroviral infections in 296 elementary school children. Swimming rates for the entire season showed no relationships to reported illnesses. This lack of a relationship appeared to be the results of a failure to find enough children who were infrequent or nonswimmers. Nevertheless, the trend toward a decreased illness rate in children who refrained from swimming for two weeks is consistent with the retrospective study results. This is thought to be the first study that has found a statistically significant association between exposure to recreational waters and an increased risk of enteroviral disease. Various internal consistencies of the data discussed in this report support the validity of the association and suggest that water served as the transportation medium, with greater risks associated with beaches than with swimming pools. (Brambley-SRC)
W81-02967

CHARACTERISTICS OF NONPOINT SOURCE URBAN RUNOFF AND ITS EFFECTS ON STREAM ECOSYSTEMS,
Utah Water Research Lab., Logan.
D. B. Porcella, and D. L. Sorensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-175409, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-032, February, 1980. 109 p, 16 Fig, 13 Tab, 368 Ref. CC81224-J.

Descriptors: *Nonpoint pollution sources, *Urban runoff, *Streams, *Ecosystems, *Literature review, Environmental effects, Pollution load, Water quality control, Evaluation, Streamflow, Water pollution control.

Literature on urban nonpoint source (NPS) runoff was surveyed to determine the magnitude of the effects of that source of contaminants to stream ecosystems. Very little information was available on ecosystem effects although extensive literature on all aspects associated with contaminant loading was available. However, urban NPS runoff probably exerts unique effects on stream communities because of its random magnitude/impulse loading of contaminants. Because control of NPS runoff is expensive, it is important to determine its actual impacts on stream communities. Stream water quality varies markedly both temporally and spatially as a function of stream flow and the interactions of the watershed, hydrologic and transport characteristics. Ecological literature provided a basis for evaluating such impacts based on benthic invertebrate biomass and diversity, measurement of community primary production and respiration, carbon cycling, and variables related to the contaminant concentrations in the stream. A stochastic approach for assessing the impacts would be most feasible for evaluating impacts of urban NPS runoff. (Brambley-SRC)
W81-02969

HIGH SPEED LIQUID CHROMATOGRAPHY AS AN ENVIRONMENTAL MONITOR OF NON-VOLATILE ORGANIC POLLUTANTS IN WATER: IN RETROSPECT--A NEW PERSPECTIVE,
Missouri Water Resources Research Center, Columbia.
C. R. Vogt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203119, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, December, 1980. 43 p, 10 Fig, 15 Tab, 66 Ref. OWRT-B-119-MO(1), 14-34-0001-7166.

Descriptors: *Chloroform, *Chlorination, *Drinking water, Biochemical tests, *Chromatography, Water pollution sources, *Pollutant identification, Chlorinated hydrocarbons, Waste water treatment, Potable water, Biochemistry, Biological samples, Animal tissues, Animal pathology, Laboratory animals, Research priorities, Environmental effects, Pollutants, Water pollution effects, Carcinogens.

Drinking water quality in Columbia, Missouri, and its vicinity was studied, with emphasis on non-volatile organic pollutants and their fate. Both qualitative and quantitative relationships of the non-volatile organic compounds, total organic carbon and chlorination were studied. In general, organics having an acetyl moiety, ethanol, or beta-hydroxyethyl alkyls, are thought to be sources of haloforms. Since similar organic structures are distributed in the human body, study was directed towards chlorination in vivo and in vitro, which has led to a new perspective in human health safety. Results showed that in vivo chlorination of rats with an acute dose of sodium hypochlorite (SH) formed the chlorinated hydrocarbon chloroform, a known carcinogen. Chloroform levels in blood, brain, liver, kidney and fat were elevated, and increased with increasing SH dosage. In vivo chloroform levels were maximum at 1.5 hours, and almost completely eliminated 24 hours after SH administration. Chloroform production from in vitro addition of SH to rat blood, brain, liver, kidney and fat was related to SH dosage, and reaction time and temperature. Overall results suggested reactions in other physiological systems similar to that observed with SH may occur on intake of heavily chlorinated water. (Zielinski-IPA)
W81-03002

PREDICTION OF SONGBIRD RESPONSES TO HABITAT ALTERATION RESULTING FROM WASTE WATER IRRIGATION,
Pennsylvania State Univ., University Park. School of Forest Resources.
C. M. Greenwald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205114, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, March, 1981. 79 p, 7 Tab, 64 Ref, 1 Append. OWRT-B-105-PA(3), 14-34-0001-8111.

Descriptors: *Song birds, *Habitats, *Waste water irrigation, Mixed forests, Vegetation, Forests, Nesting, Revegetation, Hardwood, Birds, Measurement, Environmental effects, *Ecological effects.

In an effort to predict songbird responses to habitat changes resulting from year-round spray irrigation of chlorinated municipal waste water, relationships between habitat features and attributes of songbird populations and communities were studied on Penn State's Waste Water Renovation Facility. Habitat types in the study area ranged from shrubby old fields to mixed-oak forest. Songbirds were censused at 30 randomly chosen points four times between June 1979 and May 1980. Principal components analysis of the habitat measurements resulted in a reduction of the 34 original variables to 9 habitat components. Multiple regression of avian community parameters in each season on the habitat components produced 10 significant equations; fall and winter N could not be predicted. The first principal component was the best predictor of avian community parameters. Analysis of the common bird species in each season indicated that the first, second, and fifth components were most often important for determining their distributions. Effluent irrigation in mature forest will result in decreased avian deversity and abundance, since loss of subcanopy woody vegetation will reduce essential nesting, feeding, and perching sites. Songbird diversity and abundance should increase with the increase in midstory vegetation in sprayed forests with more open canopies. In addition to these short-term changes, serious long-term habitat changes may occur, as regeneration in the mature forest appears to be reduced due to competition of hardwood seedlings with the dense herbaceous growth.
W81-03007

TRANSFER OF METHYLMERCURY IN AN EXPERIMENTAL FRESHWATER TROPHIC CHAIN--TEMPERATURE EFFECTS,
Bordeaux Univ. (France). Lab. of Ecology and Animal Ecophysiology.
For primary bibliographic entry see Field 5B.
W81-03088

WATER POLLUTION RESULTING FROM A FIRE AT A TYRE DUMP,
Clyde River Purification Board, Glasgow (Scotland).
For primary bibliographic entry see Field 5B.
W81-03089

ORGANOCHLORINE RESIDUES IN FISH OF LAKE TEXOMA, OCTOBER 1979,
Army Engineer District, Tulsa, OK.
R. G. Hunter, J. H. Carroll, and J. C. Randolph.
Pesticides Monitoring Journal, Vol 14, No 3, p 102-107, December, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Fish, *Lake Texoma, *Organochlorines, Polychlorinated biphenyls, Analysis, Analytical techniques, Aquatic life, Texas, Oklahoma, *Water pollution effects.

Concentrations of selected organochlorine compounds such as DDT and its metabolites, chlordane, heptachlor, heptachlor epoxide, dieldrin, endrin, mirex, and polychlorinated biphenyls were measured in fillets of fish from Lake Texoma, located along the Red River in Texas and Oklahoma. Ninety-nine fish, representing 11 species, were collected. Most species contained PCBs at levels of up to 1100 ng/g and p,p'-DDE as high as 127 ng/g. Carnivores did not contain p,p'-TDE or o,p'-DDT. However, these were present in herbivores and detritivores up to 36 ng/g and 17 ng/g, respectively. Similarly, heptachlor was not found in carnivores, but was present at as much as 37 ng/g in the other two types. Chlordane was detected at all trophic levels at up to 24 ng/g. Dieldrin and p,p'-DDT were found in detritivores and carnivores up to 144 ng and 410 ng/g respectively. (Baker-FRC)
W81-03093

PHYTOPLANKTON OF FRESH-WATER ORIGINS IN HUDSON BAY,
Guelph Univ. (Ontario). Dept. of Botany and Genetics.
J. Gerrath, J. C. Roff, and J. T. Anderson.
Nova Hedwigia, Vol 32, No 1, p 167-183, 1980. 4 Fig, 29 Ref.

Descriptors: *Phytoplankton, *Hudson Bay, *Algae, *Taxonomy, Aquatic plants, Aquatic life, Eutrophication.

The paper deals with taxa of fresh water origin or affinity obtained in collections from Hudson Bay. A total of 42 algal taxa were found at locations throughout the bay at distances up to 400 km from shore and up to two months after the disappearance of ice cover. Of these 42, 37 were recorded in the bay for the first time. Most of the taxa with freshwater affinities occurred in the Cyanophyceae, Chlorophyceae, Cryptophyceae and Chrysophceae, whereas most of the taxa in the Bacillariophyceae and Dinophyccae were of strictly marine affinities. A trend was noted for the maximum observed number of taxa to decline away from shore towards the center of the bay. (Baker-FRC)
W81-03094

METHANE PRODUCTION FROM ACETATE AND ASSOCIATED METHANE FLUXES FROM ANOXIC COASTAL SEDIMENTS,
North Carolina Univ. at Chapel Hill. Marine Science Program.
F. J. Sansone, and C. S. Martens.
Science, Vol 211, No 4483, p 707-709, February, 1981. 2 Fig, 19 Ref.

Descriptors: *Methane, *Acetate, *Sediments, Microbial degradation, Dissolved oxygen, Sea water, *Coastal waters.

The first seasonal measurements of microbial methane production rate from acetate in a sediment conducted in association with in situ measurements of fluxes of methane out of the sediment into the overlying water are reported. The apparent microbial conversion rate of acetate to methane ranged seasonally from 0.7 to 88 micromoles per liter of whole wet sediment per hour in the top 5 cm of methane-producing sediments underlying sulfate-reducing sediments in Cape Lookout Bight, North Carolina. Associated methane flux across the sediment-water interface into overlying waters exhibited the same seasonal pattern. Only in sulfate-depleted sediments does significant methane production from acetate occur. (Baker-FRC)
W81-03095

ENVIRONMENTAL ISSUES: STILL CLOUDED IN UNCERTAINTY,
R. M. Stanwood.
Mining Engineering, Vol 33, No 1, p 49-51, January, 1981.

Descriptors: *Mining, *Environmental effects, *Oil shale, *Colorado River Basin, Shales, Water supply, Surface waters, Water quality, Groundwater, Water pollution control, Water rights, Water policy.

Environmental impact of shale oil development is discussed. Federal and state agencies have determined that the Upper Colorado River Basin water supplies can support a 500,000 barrel per day shale oil industry to the year 2000 without curtailing other uses. However, in case of short supply or adverse weather, the shale oil industry would receive diminished supplies unless other water rights were negotiated. Water quality may be adversely affected by disruption during processing, pollution by mine waste and contamination by spent shale leachates. Possible salinity increases from water withdrawal and salt contamination in the Colorado River Basin could cause economic losses. The EPA is currently preparing oil shale pollution control guidance documents, which will be available in 1981. Although pressure for pollution control is expected to lessen, it is expected that the shale oil developer will still face many regulations and uncertainties. (Cassar-FRC)
W81-03107

CRUSTACEAN ZOOPLANKTON COMMUNITIES OF ACIDIC, METAL-CONTAMINATED LAKES NEAR SUDBURY, ONTARIO,
Ontario Ministry of the Environment, Rexdale. Limnology and Toxicity Section.
N. D. Yan, and R. Strus.
Canadian Journal of Fisheries and Aquatic Science, Vol 37, No 12, p 2282-2291, December, 1980. 3 Fig, 7 Tab, 51 Ref.

Descriptors: *Crustaceans, *Zooplankton, *Acidic water, *Lakes, Metals, Biomass, Algae, Phytoplankton, Water pollution effects, Copper, Nickel, Invertebrates, Aquatic animals, Aquatic plants, Aquatic life, Speciation, Clearwater Lake, Hannah Lake, Sudbury, *Ontario.

Crustacean zooplankton communities in 5 acidic, metal-contaminated lakes near Sudbury, Ontario, were compared with those in 6 uncontaminated lakes in the Muskoka-Haliburton region of Ontario using data collected from 1973 to 1978. In Clearwater Lake, an acidic, contaminated lake, an average of 3.7 species per sample were present, with a total of 13 species. In the non-acidic lakes, 7-15 species per sample were collected. Cladocera comprised 80-90% of the zooplankton biomass during the ice-free period in Clearwater Lake. Bosmina longirostris (O.F. Muller) comprised 89% of the adult crustaceans. Hannah Lake, the most highly metal contaminated acid lake, had the lowest zooplankton biomass. In the contaminated lakes, excluding Hannah, zooplankton biomass was not significantly correlated with pH, Cu, Ni, or total phosphorus concentrations, or with total phytoplankton biomass. Comparison with lakes which were acid, but not metal-contaminated, showed similarities in numbers of species but differences in types. Hypotheses are proposed to explain how acidity relates to phytoplankton-zooplankton interaction. (1) 50% of the phytoplankton in Clearwater Lake is unavailable as food for the zooplankton because the species present are too large to ingest, (2) changes in the phytoplankton community are not caused by zooplankton grazing but by differences in tolerance to acidity, and (3) the efficiency of energy transfer from phytoplankton to herbivorous zooplankton is reduced by metal contamination. (Cassar-FRC)
W81-03114

TERATOGENESIS IN LAKE TROUT (SALVELINUS NAMAYCUSH) IN AN EXPERIMENTALLY ACIDIFIED LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
L. A. Kennedy.
Canadian Journal of Fisheries and Aquatic Science, Vol 37, No 12, p 2355-2358, December, 1980. 1 Tab, 14 Ref.

Descriptors: *Lake trout, *Acidic water, *Teratogenesis, Embryonic growth stage, *Fish reproduction, Freshwater fish, Toxicity, Lakes, Cold water fish, Trout, Eggs, Reproduction, Water pollution effects.

Lake trout living in an experimentally acidified lake (summer epilimnion, pH 5.84, and hypolimnion, pH 6.2) for 3 years produced only 6% embryonated eggs. All of the eggs produced were anomalous. Control lakes, at pH 6.6, had a 92.9% hatching rate of normal embryos. 59% of the eggs in the acidified lake died by 15 days after laying, and 60% of the surviving embryos were grossly deformed. When eggs fertilized in the acid lake were incubated in untreated water, only 24% had gastrulated successfully within 15 days, compared with 75% of the eggs from the control lake. By day 31, only 28.6% of the eggs from the acid lake contained eyed embryos, and 74.5% from the control. Although fertilization in acid water appeared successful, early embryonic mortality was high, and total volume and dry weight of eggs were less than in normal waters. (Cassar-FRC)
W81-03116

INTERNAL HEAVY METAL CHANGES AS A CONSEQUENCE OF EXPOSURE OF MYTILUS EDULIS, THE BLUE MUSSEL, TO ELEVATED EXTERNAL COPPER(II) LEVELS,
Unity Coll., ME.
J. Sutherland, and C. W. Major.
Comparative Biochemistry and Physiology, Vol 68C, No 1, p 63-67, 1981. 2 Fig, 1 Tab, 28 Ref.

Descriptors: *Mussels, *Copper, *Pollutants, *Heavy metals, *Aquatic animals, Benthic fauna, Invertebrates, Water pollution effects.

A survey was made of the distribution of accumulated elements among various body organs of the blue mussel, Mytilus edulis, following exposure to various levels of copper for various periods of time. After exposure to 0.3 ppm copper for 24 hr, calculations were made of the concentrations of manganese, potassium, zinc, phosphorus, molybdenum, copper, iron, aluminum, magnesium, calcium, and boron in the kidney, gill, foot, viscera, mantle and whole body by plasma gel spectrography. Copper was rapidly taken up and concentrated to exceed the external level and the initial internal values in all organs examined. Exceptional levels were found in the gill and kidney. Most of the concentration is completed early, and retention is tenacious. Copper displaces aluminum and molybdenum from all organs within 4 hr. Magnesium levels were not affected. Iron was not affected except for a drop in the gill and kidney levels. Calcium seems generally unaffected except in the gills. Phosphorus showed a transient drop in all tissues, with recovery evident by 12 hr. Boron and potassium dropped everywhere, the kidney being the most pronounced area. Manganese was slightly displaced from the foot by 12 hr. (Baker-FRC)
W81-03124

COMPOSITION OF THE EARTHWORM EISENIA FOETIDA (SAVIGNY) AND ASSIMILATION OF 15 ELEMENTS FROM SLUDGE DURING GROWTH,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
R. Hartenstein, A. L. Leaf, E. F. Neuhauser, and D. H. Bickelhaupt.
Comparative Biochemistry and Physiology, Vol 66C, No 2, p 187-192, 1980. 2 Fig, 4 Tab, 16 Ref.

Descriptors: *Worms, *Sludge treatment, Invertebrates, Mineralogy, Water pollution effects, Elements, Nitrogen, Phosphorus, Sodium, Potassium, Calcium, Magnesium, Manganese, Iron, Zinc, Aluminum, Copper.

Elemental changes that occur in the earthworm as it ages and/or passes organic material through its gut were investigated. Earthworms were obtained from stock cultures in peat moss sprinkled with dolomite and placed on soil with horse manure and activated sludge as food. Activated sludge obtained from the Meadowbrook-Limestone Waste water treatment plant, Onondaga, NY, was concentrated to 11% solids by centrifugation before use. During growth periods the earthworm maintained its concentrations of water, N, P, and K at steady-state values of 18%, 10, 1, and 1%. Losses were noted in Ca, Mg, and Na. The losses in Ca and Na during a doubling of biomass appear to be relatively trivial. However, the reduction in Mg seems appreciable, ranging from 0.3 to 0.15%, dry weight. All potentially phytotoxic elements analyzed in the study are able to accumulate in earthworm tissues. However, only Cu, Zn and Pb did accumulate under the conditions in this study. No accumulation was noted of Cd, Cr and Ni. (Baker-FRC)
W81-03125

THERMOPHILIC FUNGI ISOLATED FROM A HEATED AQUATIC HABITAT,
La Trobe Univ., Bundoora (Australia). Dept. of Botany.
D. H. Ellis.
Mycologia, Vol 72, No 5, p 1030-1033, September/October, 1980. 1 Tab, 8 Ref.

Descriptors: *Fungi, *Aquatic fungi, *Thermal pollution, Heated water, Cooling water, Aquatic habitats, Hazelwood Power Station, *Australia, Microorganisms, Water cooling, Electric powerplants, Water pollution effects, Aquatic microorganisms.

Five species of thermophilic fungi were isolated from sediments in 8 sites at the Hazelwood Power Station, Australia, cooling pond. This pond is divided into 4 sections, but only the outlet segment and main pond were investigated. Temperatures graduated from 25C in the main pond to 37C at the outlet. Thermotolerant Aspergillis fumigatus Fres. was found at all sites; thermophilic fungus Thermomyces lanuginosus Tsiklinski was found at 3 of the 4 sites where temperatures were warmest. The other species were Chaetomium thermophile La Touche, Humicola grisea var. thermoidea Cooney & Emerson, and Humicola insolens Cooney & Emerson. (Cassar-FRC)
W81-03135

POPULATION STRUCTURE AND SPECIES COMPOSITION OF THE FREE-LIVING NEMATODES INHABITING SANDS OF THE NEW YORK BIGHT APEX,
City Univ. of New York. Dept. of Biology.
J. H. Tietjen.
Estuarine and Coastal Marine Science, Vol 10, No 1, p 61-73, January, 1980. 3 Fig, 6 Tab, 23 Ref.

Descriptors: *Nematodes, *Sands, *Atlantic Ocean, Population, Density, Soil microbiology, Heavy metals, Carbon, Soil types, *New York Bight.

Free-living nematodes inhabiting silty to medium coarse sands at nine stations in the New York Bight Apex were studied over a one year period. The New York Bight Apex receives large amounts of wastes generated in the area of New York City, including organic carbon and heavy metals. The average population density ranged from 221 to 1381 per 10 sq cm. There were no significant differences in density associated with sediment

type, organic carbon, or heavy metal concentrations. Populations found in medium sands with low organic carbon and low heavy metal concentration were dominated by Chromadoridae and Desmodoridae, and there were few Comesomatidae. There was high species diversity. In populations found in silty sands and in medium sands with high organic carbon or high heavy metal concentration, Comesomatidae were dominant, and there were relatively few Chromadoridae and Desmodoridae. Species diversity was low. In medium sands species diversity was inversely correlated with increased concentrations of Cr, Cu, Pb, and Zn. No such correlation was found in silty sands. There were high relative abundances of the comesomatid Sabatieria pulchra in contaminated sands. This species may be better able to tolerate stress than Chromadoridae and Desmodoridae. (Small-FRC)
W81-03152

DISEASE OUTBREAKS CAUSED BY DRINKING WATER,
Harvard School of Public Health, Boston, MA.
G. F. Craun.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1833-1839, June, 1980. 6 Tab, 28 Ref.

Descriptors: *Potable water, *Diseases, *Reviews, Human diseases, Infection, Pathology, Hepatitis, Viruses, Giardiasis, Cholera, Amebiasis, Groundwater pollution, Drinking water.

Articles appearing in the recent literature and dealing with the occurrence of disease caused by drinking water contamination are cited. In municipal water systems the major causes of outbreaks appeared to be contamination of the distribution system and treatment deficiencies. In semipublic water systems the use of untreated ground water and treatment deficiencies, including inadequate treatment and interrupted chlorination, caused most of the outbreaks. Giardia lamblia was the most commonly identified pathogen. Several studies have emphasized the importance of preventive measures in maintaining safe water supplies; they have included assessment of costs. Studies specifically dealing with amebiasis, cholera, giardiasis, hepatitis A, yersiniosis, and viral gastroenteritis are cited. The role of water supplies in improving health in poor countries was considered in articles such as one which demonstrated that a readily available supply of good quality water decreased diarrheal disease. It was noted that water borne disease transmitted by ingestion of the pathogen in water can be prevented by improved water quality and sanitation methods, that 'water-washed disease' is an infection of the intestinal tract and skin that can be reduced by increased availability of water and improved domestic and personal hygiene, and that water-based disease can be prevented by decreasing the need for water contact. (Baker-FRC)
W81-03186

BIOACCUMULATION AND BIOAMPLIFICATION OF MERCURY DERIVATIVES BY A TERTIARY CONSUMER: SALMO GAIRDNERI - TEMPERATURE EFFECTS. (BIOACCUMULATION ET BIOAMPLIFICATION DES DERIVES DU MERCURE PAR UN CONSOMMATEUR DE TROISIEME ORDRE: SALMO GAIRDNERI - INCIDENCES DU FACTEUR TEMPERATURE),
Bordeaux-1 Univ., Talence (France). Lab. d'Ecologie Animale.
A. Boudou, F. Ribeyre, A. Delarche, and R. Marty.
Water Research, Vol 14, No 1, p 61-65, January, 1980. 6 Fig, 8 Ref.

Descriptors: *Mercury, *Bioaccumulation, *Fish, Absorption, Biological magnification, Biotransformation, Food chains, Methylation, Methylmercury.

Biological methylation of inorganic compounds by bacteria and bioconcentration and bioamplification of the contaminant with time as well as between different trophic levels were studied. The tertiary consumer Salmo gairdneri Richardson was studied, since terminal links are most strongly contaminated by trophic transfers and their lifetimes are often longer than those of lower level species. Mercury bioaccumulation was strongly temperature dependent. Trophic contamination clearly predominated over direct contamination of Salmo gairdneri, analyzed by mortality tests and by metal determination in fish and in their principal organs. Parameters varied were the chemical form (mercury bichloride and methylmercury chloride) of metal concentration in the medium (1 microg/liter - 1 mg/liter), exposure time (10-30 days) and temperature (10, 18 and 26C). A comparative study was made with Carrassius carrassius. Global contamination (water and food) of Salmo gairdneri was studied within the experimental trophic chain of a primary producer, Chlorella vulgaris, and three levels of consumers (Daphnia maga, Gambusia affinis and Salmo gairdneri) with a contaminant dose of 1 microg/liter at the same temperatures and contamination times. Hg203 was used to trace the progress. The Hg concentration factor in terms of initial contaminant dose was 2500 at 10C, 5900 at 18C and 3100 at 26C. (Hertzoff-FRC)
W81-03191

TOXICOLOGICAL AND PHYSIOLOGICAL RESPONSES OF THE FISH, LEIOSTOMUS XANTHURUS, EXPOSED TO CHLORINE PRODUCED OXIDANTS,
Gulf Breeze Environmental Research Lab., Johns Island, SC, Bears Bluff Field Station.
D. P. Middaugh, L. E. Burnett, and J. A. Couch.
Estuaries, Vol 3, No 2, p 132-141, June 1980. 10 Fig, 3 Tab, 47 Ref.

Descriptors: *Toxicity, *Fish, *Chlorination, *Leiostomus xanthurus, Chlorine, Water pollution effects, Aquatic life, Aquatic animals, Spot.

The sublethal and lethal toxicity of chlorine-produced oxidants (CPO) was determined on juvenile spot, Leiostomus xanthurus, an estuarine teleost. Seawater of 26-31% salinity was treated with varying concentrations of NaOCl to simulate conditions in chlorinated secondary sewage treatment effluents and chlorinated cooling water. Short term LT50 tests (measured CPO, 0.09 and 0.12 mg per liter) produced no mortality in fish in the 48 hour duration of the test. CPO concentrations (mg per liter) produced the following LT50's: 0.13, 360-400 min; 0.19, 216-250 min; and 0.36, 88-95 min. Opercular ventilation rates were higher in fish exposed to the sublethal concentrations, but returned to near normal (65 beats per min) during the latter part of the 48 hour experiment. Opercular ventilation rates in fish exposed to higher, fatal concentrations of CPO increased dramatically with time to as high as 217 beats per min and decreased slightly just before death. Blood pH decreased to as low as 6.84, compared with 7.35 in controls, in all but the lowest concentration of CPO. No significant changes in methemoglobin were observed. Oxygen uptake was depressed at all CPO concentrations. Gill tissue epithelium was sloughed away from underlying pillar cells. Circulatory tissues and hemangiectic secondary lamellae were denuded in fish exposed to the highest CPO concentration, 0.37 mg per liter. (Cassar-FRC)
W81-03192

DECOMPOSITION PROCESSES IN THE PROFUNDAL REGION OF BLELHAM TARN AND THE LUND TUBES,
Freshwater Biological Association, Windermere (England).
For primary bibliographic entry see Field 2H.
W81-03196

EVALUATION OF ACUTE TOXICITY OF PHENOL AND ITS CHLORO- AND NITRO-DERIVATIVES TO CERTAIN TELEOSTS,
D.A.V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, S. Rani, A. K. Tyagi, and R. C. Dalela.
Water, Air, and Soil Pollution, Vol 14, p 95-102, 1980. 5 Tab, 31 Ref.

Descriptors: *Teleosts, *Toxicity, *Phenols, Water pollution effects, Fish, Aquatic animals, Organic compounds, Chemical wastes, Aromatic compounds, Pentachlorophenol, Dinitrophenol.

The comparative acute toxicities of phenol, pentachlorophenol, and dinitrophenol were determined in 24, 48, 72, and 96 hour tests using 3 species of fish. Acute 96 hour LC50 values for the 3 species of fish were as follows: phenol, 11.6-42.0 mg per liter; dinitrophenol, 1.00-9.25 mg per liter; and pentachlorophenol, 0.072-0.56 mg per liter. Of the 3 species of fish, Notopterus notopterus was most susceptible to the chemicals; Saccobranchus fossilis and Colisa fasciatus were less susceptible. (Cassar-FRC)
W81-03202

EFFECTS OF A SKI AREA ON THE WATER QUALITY AND INVERTEBRATES OF A MOUNTAIN STREAM,
New Mexico Univ., Albuquerque. Dept. of Biology.
M. C. Molles, Jr., and J. R. Gosz.
Water, Air, and Soil Pollution, Vol 14, p 187-205, 1980. 9 Fig, 5 Tab, 26 Ref.

Descriptors: *Invertebrates, *Recreation facilities, *Streams, Chlorides, Construction, Road construction, Skiing, Sedimentation, *Water pollution effects, Winter sports, *Santa Fe, New Mexico, Nutrients, Salts, Aquatic animals, Suspended solids, Mayflies, Diptera, Insects, Oligochaetes, Nematodes.

Past studies of the area downstream from the Santa Fe, New Mexico ski area demonstrated the effect of road salting and road construction on chemical composition of the water and aquatic life. This paper extends the study further downstream to quantify the rate of recovery of water quality and the longitudinal recovery of stream invertebrate communities. Road salt applications significantly increased Na and Cl levels in the stream water. Levels were highest during spring snow melt and during a few periods in the summer. Ca, Mg, and K levels were also increased because of the mass action displacement from soil exchange sites by Na. Suspended sediment levels reflected stream discharge and soil distribution activity in the area and contributed more to reductions in the invertebrate population than did the chemistry of the water. Below the ski area Ephemeroptera, Coleoptera, Diptera, and Turbellaria were significantly reduced; Trichoptera and Nematoda were present in higher numbers. Plecoptera and Oligochaeta populations were consistent throughout the area. Some recovery of invertebrate production was recorded at distances of 700 to 2200 meters below the ski area. (Cassar-FRC)
W81-03203

REPORT ON HEALTH AND ENVIRONMENTAL EFFECTS OF INCREASED COAL UTILIZATION, BY THE COMMITTEE ON HEALTH AND ENVIRONMENTAL EFFECTS OF INCREASED COAL UTILIZATION.
Environmental Health Perspectives, Vol 36, p 135-153, November, 1980. 9 Ref.

Descriptors: *Acidic water, *Coal mine wastes, *Water pollution effects, *Coal utilization effects, Trace elements, Powerplants, Waste disposal, Coal, Thermal pollution, Mine wastes, Water pollution sources, Toxins, Public health, Soil contaminant effects, Air pollution, Surface waters, Groundwater, Radioisotopes, Lead, Mercury, Arsenic, Aquifers, Burning, National Energy Plan, Landfills, Disposal, Research and development, Water pollution control, Regulations, Water cooling, Cooling water, Metals, Cadmium.

The Committee on Health and Environmental Effects of Increased Coal Utilization studied the effects of the National Energy Plan, announced April 1977, during November and December, 1977. Increase in coal consumption, from 665 million tons to possibly 1265 million tons by 1985, can directly and indirectly affect water resources. Acid rains from stack emissions have diminished and destroyed aquatic life in lakes and streams and have reduced rates of forest growth. Trace elements such as As, Cd, Hg, Pb, F, Be, and radionu-

clides U235, U238, and Th232 may enter groundwater and streams during mining, from emissions during coal burning, or from waste disposal sites with subsequent entrance into the food chain and bioaccumulation. Acid mine waters from inactive mines in the eastern U.S. and increased salinity in western soils may enter disturbed aquifers and surface waters. Cooling waters associated with coal-fired power plants are locally problematic, but offer possibilities for creative use of this waste heat. The Committee had several recommendations pertinent to water resources: (1) establish an improved national environmental data collection and monitoring system, (2) require rigorous compliance with governmental regulations, (3) expand research programs, (4) initiate a major study on SO2-nitrogen oxide emissions, acid fallout and biomass productivity, and (5) study migration of toxic trace elements from waste disposal sites into the biosphere. (Cassar-FRC)
W81-03217

PRIMARY PRODUCTION IN LAKES ROTORUA, REREWHAKAAITU, AND ROTOITI, NORTH ISLAND, NEW ZEALAND, 1973-78,
Ministry of Agriculture and Fisheries, Wellington. (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 2H.
W81-03222

THE LITTORAL BOTTOM FAUNA OF HIGH ELEVATION LAKES IN KINGS CANYON NATIONAL PARK,
California Univ., Berkeley. Dept. of Forestry and Resource Management.
T. P. Taylor, and D. C. Erman.
California Fish and Game, Vol 66, No 2, p 112-119, April, 1980. 2 Fig, 2 Tab, 25 Ref.

Descriptors: *Water pollution effects, *Eutrophication, *Lakes, *Benthic fauna, National parks, Recreation facilities, Invertebrates, *Kings Canyon National Park, *California, Oligotrophy, Aquatic life, Clams, Oligochaetes, Diptera, Public lands, Camping, Lake sediments, Limnology, Littoral.

Macroinvertebrate density was positively correlated with human use (camping and visiting) along the shores of 11 oligotrophic, high elevation lakes in Kings Canyon National Park, California. Average density was 5418 individuals per sq meter. Most common invertebrates were Chironomidae, 1437 individuals; Oligochaeta, 2135; and fingernail clams, 1567. The presence of Chironomids was an indication of eutrophication or human impact. Bullfrog Lake had a high frequency of bottom plants and a high macroinvertebrate density. This lake, closed to use for over 10 years, shows a slow recovery from the effects of former overuse by campers and grazing stock. (Cassar-FRC)
W81-03223

EFFECTS OF PETROLEUM HYDROCARBONS ON HEPATIC FUNCTION IN THE DUCK,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
J. F. Patton, and M. P. Dieter.
Comparative Biochemistry and Physiology, Vol 65C, No 1, p 33-36, 1980. 3 Fig, 2 Tab, 22 Ref.

Descriptors: *Ducks, *Oil, *Toxicity, Organic compounds, Birds, Mallard ducks, Wildlife, Migratory birds, Oil spills, Environmental effects.

The effects of chronic ingestion of representative petroleum hydrocarbons found in South Louisiana crude oil were studied on liver function in the adult duck. One group of mallard ducks was fed breeder mash containing a 1% mixture of 0.96% paraffin and 0.04% (400 ppm) of an aromatic hydrocarbon mixture. Another group received 4000 ppm aromatic hydrocarbon exposure in their meals. The average monthly body weights of these two groups varied over the 7 month period of study. Those of the second group decreased 21% during the first month. After that time, however, weights again increased, reaching normal levels at 5 months' time. In the first group body weight also diminished, but returned to normal after 5 months' time. No significant changes in values for the hematocrit, plasma Na+ and K+, and GOT were noted. Both the liver and testis were measured at necropsy, and a significant increase was noted for those in the first groups. (Baker-FRC)
W81-03234

RESPONSE OF CAPTIVE, BREEDING MALLARDS TO OILED WATER,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
T. W. Custer, and P. H. Albers.
Journal of Wildlife Management, Vol 44, No 4, p 915-918, October, 1980. 3 Fig, 9 Ref.

Descriptors: *Mallard Duck, *Oily water, *Water pollution effects, Waterfowl, Wildlife, Aquatic life, Oil pollution.

Studies on 2-year old game-farm mallards suggested that these birds attempt to avoid oily water, especially after initial contact. Three groups of 17-18 paris each were exposed to the following conditions in their sunken water troughs: high crude oil concentration with a visible slick (100 ml per sq meter of water surface), low oil concentration with no visible slick (5 ml per sq meter), and no oil as controls. After 4 hours, 2 of 10 in the high oil group had entered the water, 4 of 8 in the low oil group, and 8 of 10 in the control group. After 24 hours, the rate was 4 of 10, high oil; 5 of 8, low oil; and 9 of 10, control. After the oil was removed and replaced with clean water, ducks in the high oil group entered the water fewer times and spent less time in the water than ducks in the other 2 groups. (Cassar-FRC)
W81-03237

ETIOLOGY OF GAS BUBBLE DISEASE,
National Fisheries Research Center, Seattle, WA.
G. R. Bouck.
Transactions of the American Fisheries Society, Vol 109, No 6, p 703-707, November, 1980. 10 Fig, 4 Tab, 34 Ref.

Descriptors: *Supersaturation, *Fish diseases, Lethal limit, Water pollution effects, Morbidity, Mortality.

The cause and effect relationships which occur in gas bubble disease are discussed. Gas bubble disease is a non-infectious, physically induced process caused by uncompensated hyperbaric pressure of total dissolved gases. The abnormal physical presence of the gases in blood and tissue can cause damage and death in fish and invertebrates. Mortality curves were studied, and three disease stages were revealed. Stage one is a period of gas pressure equilibrium, nonlethal cavitation, and increasing morbidity. Stage two is a period of rapid and heavy mortality. Stage three is a period of protracted survival, despite lesions and dysfunction, that eventually ends in total mortality. There are really no safe limits for supersaturation. Limits can be set depending on species tolerance and on factors that differ among hatcheries and rivers, between continuous and intermittent exposures, and across ranges of temperature and salinity. (Small-FRC)
W81-03241

EFFECTS OF HYDROSTATIC PRESSURE ON STEELHEAD SURVIVAL IN AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., OR.
M. D. Knittel, G. A. Chapman, and R. R. Garton.
Transactions of the American Fisheries Society, Vol 109, No 6, p 755-759, November, 1980. 2 Fig, 2 Tab, 13 Ref.

Descriptors: *Supersaturation, *Fish diseases, *Hydrostatic pressure, Water depth, Mortality, Morbidity, Water pollution effects, *Air-supersaturated water.

This study was designed to determine whether compensating hydrostatic pressure and excess gas pressure are simple additive factors in determining fish survival, and to determine the extent to which total hydrostatic compensation can reverse the effect of a previous near-lethal exposure to supersaturation. Juvenile steelheads were placed in cages and suspended at various depths in water supersaturated with air at levels from 120 to 140% of normal atmospheric gas pressure. Fish held at depths of 10, 50, and 100 cm had survival times that increased with increasing depth. When the hydrostatic pressure (7.4 mm Hg per 10 cm water depth) was subtracted from the excess gas pressure, mortality curves for fish at all three depths essentially coincided. The significant measure of supersaturation appears to be the pressure of dissolved gases in excess of the sum of barometric and hydrostatic pressures. When steelheads were held near the surface in supersaturated water for a near-lethal period and then lowered to a depth providing total hydrostatic compensation, they appeared to recover completely in about two hours. (Small-FRC)
W81-03242

COMPARATIVE RESPONSES OF SPECKLED DACE AND CUTTHROAT TROUT TO AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., OR.
A. V. Nebeker, A. K. Hauck, F. D. Baker, and S. L. Weitz.
Transactions of the American Fisheries Society, Vol 109, No 6, p 760-764, November, 1980. 1 Fig, 2 Tab, 10 Ref.

Descriptors: *Supersaturation, *Fish diseases, *Mortality, Trout, Water pollution effects, Lethal limit, Morbidity, *Air-supersaturated water.

Comparative studies were performed on the responses of speckled dace and cutthroat trout to supersaturated water which was prepared by injecting compressed air into water under pressure. The speckled dace were more tolerant of the air-supersaturated water than were adult or juvenile cutthroat trout. The dace were tested in water with 110 to 142% supersaturation. They had a 96-hr LC50 (median lethal concentration) of 140%, a 7-day LC50 of 137% saturation, and 2-week LC50s of 129 or 131% saturation. The estimated mean threshold concentration, based on time to death of 50% of test fish, was 123% saturation. The cutthroat trout were tested in the range, 111 to 130% saturation. They had a 96-hr LC50 of 119-120% saturation for adults and 119% for juveniles. The two types of fish showed similar external and internal signs of gas bubble disease. Thus, speckled dace would have a greater chance of survival in a stream with air-saturation stress than cutthroat trout. (Small-FRC)
W81-03243

AVOIDANCE RESPONSES OF SALMON AND TROUT TO AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
D. G. Stevens, A. V. Nebeker, and R. J. Baker.
Transactions of the American Fisheries Society, Vol 109, No 6, p 751-754, November, 1980. 1 Fig, 1 Tab, 5 Ref.

Descriptors: *Fish behavior, *Supersaturation, *Fish diseases, Sounding, Salmon, Trout, Water pollution effects, *Air-supersaturated water.

The lateral avoidance response of several fish species was tested in various concentrations of supersaturated water. All tests were done in unchlorinated well water aerated to near saturation under normal atmospheric pressure using parr-smolt size steelhead, coho, chinook, and sockeye salmon and rainbow trout. Coho, sockeye, and chinook salmon and rainbow trout avoided air-supersaturated water, but steelheads did not consistently avoid the supersaturated water and died from gas bubble disease. The salmon and trout generally avoided 145% and 125% saturation, but did not always avoid 115%. Territorial activity was found to reduce avoidance by steelheads and trout. The research did not assess the possibility that steelheads and other species may sound vertically to avoid supersaturated water. (Small-FRC)
W81-03244

ATMOSPHERIC GAS SUPERSATURATION: EDUCATIONAL AND RESEARCH NEEDS,

National Fisheries Research Center, Seattle, WA.
G. R. Bouck, B. D'Aoust, W. J. Ebel, and R. Rulifson.
Transactions of the American Fisheries Society, Vol 109, No 6, p 769-771, November, 1980.

Descriptors: *Supersaturation, *Fish diseases, *Research needs, Education, *Gases, Water quality, Water pollution effects, Water pollution control, Fisheries engineering, Fishkill, Stream fisheries.

A list of supersaturation research needs is presented, including educational needs, standardization of methods, ecosystem research, aquaculture research, and treatment to eliminate supersaturation. Academic institutions teaching water quality or fish culture or pathology should give direct training on the causes, measurement, consequences, and cures of hyperbaric dissolved gas pressures. Also, there is a basic need to standardize methods used in supersaturation research. Research is needed to determine how much supersaturation is bad for fish. Sublethal effects have received little attention. There are a number of unresolved physiological questions that may prove critical to ecosystems and fish culture studies, such as the role of simple hydraulic compression on gas nucleation in fish. Treatment methods are needed for supersaturated water. They should be reliable, cheap, and effective. There is, in general, a great need for more research on gas supersaturation and how it relates to gas bubble disease, and a great need for scientists, engineers, and facility operators trained in the monitoring and mitigation of gas supersaturated waters. (Small-FRC)
W81-03245

GAS BUBBLE DISEASE IN SMALLMOUTH BASS AND NORTHERN SQUAWFISH FROM THE SNAKE AND COLUMBIA RIVERS,
Battelle. Pacific Northwest Lab., Richland, WA. Ecological Sciences Dept.
J. C. Montgomery, and C. D. Becker.
Transactions of the American Fisheries Society, Vol 109, No 6, p 734-736, November, 1980. 3 Fig, 11 Ref.

Descriptors: *Supersaturation, *Fish diseases, *Morbidity, Bass, Seasonal variation, Rivers, Field investigations, Waterpollution effects, *Snake River, *Columbia River, Gas bubble disease.

Field observations were made on the external signs of gas bubble disease among adult smallmouth bass and northern squawfish in the lower Snake and mid-Columbia rivers during spring freshets of 1975 and 1976. One hundred and seventy-nine smallmouth bass and 85 northern squawfish were collected by angling and were examined. Seventy-two percent of the bass and 84% of the northern squawfish displayed evidence of exposure to supersaturated water. The primary signs of gas bubble disease were dermal emphysemas, which ranged in number from 25 to 300 in fins to over 800 on body and fins. Opercular emphysemas were also typical, and hemorrhaging was common on the caudal, anal, and pectoral fins. Total dissolved gas supersaturations in the river exceeded 115%. Assessment of the impact of supersaturation should include collection and examination of juvenile and adult resident fishes. The USEPA desired standard for supersaturation is a maximum of 110% for periodic exposure. (Small-FRC)
W81-03246

5D. Waste Treatment Processes

DESIGN AND CONTROL OF AN ACTIVATED SLUDGE PROCESS FOR MUNICIPAL WASTE WATER TREATMENT,
Delaware Univ., Newark. Dept. of Chemical Engineering.
R. Paterson, and M. M. Denn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202111, Price codes: A15 in paper copy, A01 in microfiche. Water Resources Center, University of Delaware, Completion Report, December, 1980. 302 p, 57 Fig, 22 Tab, 133 Ref, 16 Append. OWRT-A-041-DEL(2), 14-34-0001-9008.

Descriptors: *Municipal waste water, *Activated sludge process, *Waste water treatment, Computer models, *Model studies, Computers, Model testing, Waste water, Municipal wastes, Domestic wastes, Solid wastes, Industrial wastes, Sludge, Activated sludge, Waste water management, Waste water disposal, Wastes, Suspended solids, Sedimentation, Sludge solids.

A steady-state computer model has been developed for a conventional activated sludge waste water treatment system for use in selecting the least cost system design that would satisfy a set of fixed effluent quality standards. Alternative designs slightly more expensive than least cost design but which might offer superior overall plant performance may also be treated by the model. Optimization studies on a plant to treat 20,000 cubic meters/day (5.3 MGD) medium strength domestic waste water were conducted by simple enumeration. Computer designs were generated for combinations of percent primary suspended solids removal, mixed liquor volatile suspended solids, and sludge age. System design can be specified on the basis of best effluent quality or best plant stability to diurnal loading variations without paying a large cost penalty. A dynamic computer model of a conventional activated sludge process was also developed for use in comparing alternative control strategies and alternative plant designs. (Zielinski-IPA)
W81-02905

TOXICITY REDUCTION THROUGH CHEMICAL AND BIOLOGICAL MODIFICATION OF SPENT PULP BLEACHING LIQUORS,
State Univ. of New York at Syracuse. Coll. of Environmental Science and Forestry.
C. W. Dence, C-J. Wang, and P. R. Durkin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-179334, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-039, January, 1980. 111 p, 12 Fig, 29 Tab, 68 Ref, 2 Append. R 804779.

Descriptors: *Phenols, *Chlorination, *Pulp wastes, *Bleaching wastes, *Waste water treatment, Algae, Fungi, Daphnia, Bioassay, Toxicity, Growth, Detoxification, Chemical reactions, Duckweed, Biological waste water treatment, Water pollution control.

Chlorophenols similar to or identical with those detected in spent chlorination and caustic extraction liquors were synthesized over a range of concentrations to determine their effect on the growth of fungi, the alga Chlorella pyrenoidosa, and Lemna perpusilla, and on the survival of Daphnia magna. Chlorella was the most sensitive plant tested, while Daphnia was more sensitive than the fungi in acute toxicity bioassays with spent chlorination and caustic extraction liquors. Growth repression and toxicity generally increased with increasing chlorine substitution in the phenolic ring. Spent chlorination and caustic extraction liquors were subjected to a variety of chemical treatments and fractionation and the resulting effects on acute toxicity determined. Treatment with chlorine, hypochlorous acid, hypochlorite, ozone and hydrogen peroxide produced increases in the toxicity of the spent liquor. The fraction containing the lower molecular weight materials displayed the greatest repression of fungal growth and were most toxic to the Daphnia. Substantial reductions of toxicity were achieved by the addition of alkali to spent chlorination liquor. A mixed microbial population, and Candida utilis effected essentially complete elimination of toxicity from spent chlorination liquor and small reductions in toxicity of spent caustic extration liquor, but a bacterial culture was comparatively ineffective. Substitution of chlorine dioxide or oxygen in the chlorination stage was distinctly beneficial in reducing toxicity. (Brambley-SRC)
W81-02935

PROCESS SPILL MONITORING, CONTROL AND RECOVERY IN THE PULP AND PAPER INDUSTRY,
Tufts Univ., Medford, MA. Dept. of Civil Engineering.
G. W. Gove, J. J. McKeown, and A. J. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131971, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-80-211, February, 1981. 5 p, 6 Fig, 3 Tab.

Descriptors: *Pulp wastes, *Pulp and paper industry, Kraft mills, *Computers, *Waste water treatment, Chemical recovery, Recycling, Process control, Industrial wastes, Computer models, *Waste water management.

In order to develop strategies to control intermittent spills associated with the production of chemical wood pulp, examinations of process effluents from kraft pulp mills and investigations of existing loss control systems were conducted. Samples were analyzed from process and liquor storage areas and sewers in 20 pulp mills, representing various locations, ages, process types, and wood species. Dynamic computer modelling, using data from process effluent monitoring, was employed to illustrate the utility of this technique to arrive at various loss control strategies for particular process configurations. A loss control strategy for pulping, pulp washing, and chemical recovery areas was implemented in the existing spill control system of a large kraft pulp mill. Control was successfully effected utilizing a digital computer. During a representative 18-day period the system intercepted and returned nearly 900,000 gallons containing more than 12 tons of sodium, 15 tons of biochemical oxygen demand and 67 tons of dissolved solids. In addition to managing process losses, the direct digital control system allowed gathering, processing and managing data obtained from the sensors monitoring the system. (Moore-SRC)
W81-02942

ALASKA VILLAGE DEMONSTRATION PROJECTS, FINAL REPORT,
Corvallis Environmental Research Lab., OR. Freshwater Div.
B. H. Reid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190812, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/3-80-039, March, 1980. 60 p, 16 Fig, 6 Tab, 17 Ref, 1 Append.

Descriptors: *Water supply, *Waste water treatment, *Public health, *Potable water, Water pollution control, *Rural areas, Water conservation, Operating costs, Water pollution prevention, Utilities, Maintenance costs, *Alaska.

The Alaska Village Demonstration Projects (AVDP) called for the design and construction of one or more central community facilities to demonstrate methods which provide for safe water and the elimination or control of water pollution in those native villages in Alaska without such facilities. Two demonstration projects were built at Emmonak and Wainwright as authorized by Section 113 of PL 92-500. Modular construction was used to provide central utility systems which included water supply, laundry, bathing, saunas, and waste water treatment. Service to homes was by vehicular delivery. Fire destroyed the facility at Wainwright in 1973 and the project was subsequently rebuilt. Energy conservation measures were employed to minimize costs of operation and water was treated for reuse. Equipment performed satisfactorily, but operator preparedness was lacking, thus, many breakdowns occurred. Overall cost of operation and maintenance of the facilities was transferred to the local government by the EPA. The AVDP was paralleled by projects built by the Alaska Department of Environmental Conservation (ADEC) at 11 locations. Small communities need outside support for operation and maintenance of utility systems. Time and training will be required to prepare local residents to assume managerial responsibilities for these projects. (Brambley-SRC)
W81-02944

REDUCING WASTE WATER FROM CUCUMBER PICKLING PROCESS BY CONTROLLED CULTURE FERMENTATION,
North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 3E.
W81-02949

INNOVATIVE DESTRUCTION OF COMPLEX INDUSTRIAL WASTES - AUTO OXIDATION OF TANNERY BEAMHOUSE WASTE WATER,
Science and Education Administration, Philadelphia, PA. Eastern Regional Research Center.
D. G. Bailey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-129025, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-80-210, January, 1981. 3 p, 1 Fig.

Descriptors: *Tannery wastes, *Waste water oxidation, *Sulfides, *Waste water treatment, Ionization, Industrial wastes, Cavitation, Chemical oxygen demand, Proteins, Nitrogen, Ultraviolet radiation.

The effluent stream from the unhairing process in a tannery is a difficult waste to treat by conventional methods. A novel destruction technique for treating potentially toxic pollutants was evaluated using tannery unhairing effluent. The process is based on a free-radical, auto-oxidation mechanism of breakdown of the waste. The free radicals are produced by passing the solution under pressure through an orifice. The collapse of gas bubbles in cavitation can develop very high local temperatures, which can lead to ionization effects, and the production of hydroxy-free radicals and peroxides. Tannery unhairing waste was treated in a pilot plant scale auto-oxidation unit. This waste is highly alkaline with a pH generally higher than 11, and has a chemical oxygen demand greater than 50,000 mg/l, consisting largely of protein and sulfide. In static tests, auto-oxidation effectively and rapidly removed sulfide from the waste. Removal of chemical oxygen demand, nitrogen, and suspended solids was considerably less effective. Combining the auto-oxidation with ultraviolet light and a hydrogen peroxide addition improved the chemical oxygen demand very little. (Moore-SRC)
W81-02960

SPRAY IRRIGATION--A LAND DISPOSAL PRACTICE FOR DECONTAMINATING LEACHATE FROM SANITARY LANDFILLS,
Science and Education Administration, Morgantown, WV.
H. A. Menser, W. M. Winant, and O. L. Bennett.
Agricultural Research Results ARR-NE-4, September, 1979. 51 p, 17 Fig, 19 Tab, 19 Ref.

Descriptors: *Land disposal, *Spray irrigation, *Leachates, *Sanitary landfills, Waste water irrigation, *Waste water treatment, Heavy metals, Aeration, Odor control, Organic matter, Soil chemistry.

Spray irrigation for land disposal of leachate from the Mercer County, West Virginia, Sanitary Landfill has been used effectively to decontaminate waste water since 1973. Organic and elemental pollutants in leachate, applied in amounts ranging from 38 to 155 cm over 8 months, declined to generally acceptable levels without affecting soil permeability as water percolated through 60 cm of soil. Subsoil acidity declined as Ca and Mg moved in percolate through the soil. Manganese concentrations exceeded proposed water quality standards during intense irrigation but fell to acceptable levels during rest periods. Native deciduous trees and introduced forage grasses generally withstood leachate irrigations and tended to concentrate waste elements. Soils retained Ca, Mg, K, Fe, and Zn in surface layers but Na, Al, and Mn were dispersed throughout the profile. Hazardous concentrations of potentially toxic heavy metals (Cu, Cr, Cd, Pb and Ni) were not detected at any time in soils, vegetation, or soil percolates. Noxious odor control and waste stabilization were important benefits of leachate aeration. (Moore-SRC)
W81-02962

BEHAVIOR OF COAL ASH PARTICLES IN WATER: TRACE METAL LEACHING AND ASH SETTLING,
Tennessee Valley Authority, Chattanooga.
T-Y. J. Chu, B. R. Kim, and R. J. Ruane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-174443, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/7-80-067, March, 1980. 194 p, 33 Fig, 25 Tab, 81 Ref, 6 Append.

Descriptors: *Powerplants, *Settling basins, *Settleable solids, *Trace metals, *Leaching, Water pollution control, Heavy metals, Effluent streams, Hydrogen ion concentration, Industrial wastes, *Fly ash, Water treatment.

Field surveys of ash ponds at 12 TVA coal-fired power plants and laboratory tests were undertaken to determine how adjustments in pH and reduction of suspended solids concentrations affect trace metal concentrations in ash pond discharges. The chemical characteristics of the effluents are affected by the ash material and the quantity and quality of water for sluicing. The pH varies from 3-12, depending on the content of sulfur oxides, alkaline metal oxides, and the buffering capacity of the water. The pH may be adjusted by controlling the ash-to-water ratio, combining effluents with other wastewaters within power plants, or adding chemicals. Because of high ash concentration during sluicing, 90% of fly ash particles follow hindered-zone settling behavior and settle faster than those remaining ash particles. The leaching of trace metals from ash depends on the concentration of each metal in the ash matrix, its chemical bonding in the ash, particle size of the ash, and pH. Trace metals in 14 ash pond effluents were monitored quarterly. Several occurred in potentially toxic quantities and some were present in both dissolved and suspended forms. Adjustment of effluent pH to 6-9 and reduction of suspended solids concentrations to 30 mg/l reduced the concentrations of chromium, copper, lead, and zinc, but did not appreciably reduce the total concentrations of arsenic, boron, cadmium, iron, manganese and selenium. (Brambley-SRC)
W81-02968

REMOVAL OF FLUORIDES FROM INDUSTRIAL WASTE WATERS USING ACTIVATED ALUMINA,
Versar, Inc., Springfield, VA.
I. Frankel, and E. Juergens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-190549, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-058, March, 1980. 52 p, 3 Fig, 3 Tab, 9 Ref, 4 Append. R-804377.

Descriptors: *Waste water treatment, *Industrial wastes, *Fluorides, *Chemical treatment, Process water, Capital costs, Operating costs, Activated alumina.

Activated alumina can be used to remove small quantities of fluoride from water and it was the aim of this project to adapt this process to fluoride removal from process waste waters generated by the feldspar wet-processing industry. A four-step, bench-scale process was developed that is capable of removing at least 92% of the soluble fluoride from feldspar flotation process waste waters at a projected cost of $1.03/kkg ($0.93/ton) of feldspar. For a 163,000 kkg/year (180,000 ton/year) plant, the initial capital expenditure would be about $200,000. The waste water is pretreated with sodium hydroxide, lime, and calcium chloride, which removes an initial 50 to 60% of fluoride. The clarified water is then passed through a bed of activated alumina for further fluoride removal. The activated alumina is regenerated with a 1% sodium hydroxide solution, and fluoride in the caustic liquor is effectively precipitated with calcium chloride. The fluoride can be recovered in concentrated form as insoluble calcium fluoride filter cake. The capital and product operating costs are considered to be outside the scope of the feldspar industry for implementation. (Brambley-SRC)
W81-02970

DEVELOPMENT OF NON-FOULING PIEZOELECTRIC ULTRAFILTRATION MEMBRANES,
Pennwalt Corp., King of Prussia, PA. Central Research and Development Dept.
For primary bibliographic entry see Field 3A.
W81-02975

ORGANIC POLLUTANTS IN GROUND-RECHARGED WATER,
Arizona Univ., Tucson. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W81-03008

THE EFFECT OF SOIL ON THE RENOVATION OF ACID COAL MINE DRAINAGE WATER,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
R. C. Cronce, L. T. Kardos, and E. J. Ciolkosz.
Journal of Environmental Quality, Vol 9, No 4, p 621-626, Oct/Dec, 1980. 1 Fig, 4 Tab, 13 Ref. OWRT-B-086-PA(3), 14-34-0001-6114.

Descriptors: *Percolation, *Acid mine water, *Acid drainage, Groundwater movement, Infiltration, Percolating water, Soil water movement, Perennial ryegrass, *Soil environment, *Waste water treatment, Mine drainage, Acid streams, Mine wastes, Water reuse, Drainage water.

This study was initiated to determine under field conditions the feasibility of using soil as a medium for the renovation of acid mine drainage water. Acid water from a stream was applied weekly at three levels (0, 12.5, and 25 cm/week) to an unlimed and a limed (20 metric tons/ha) floodplain soil. Soil water samples were collected weekly at soil depths of 25, 75, and 130 cm. The soil water samples and the acid water were analyzed for pH, total acidity, Al, Fe, Mn, K, CA, Mg, Na and SO sub 4. The effect of liming, levels of acid water irrigation, and depth in the soil profile on the soil water quality were determined. Initially both the unlimed and limed areas had considerable capacity for renovating the applied acid water. However, with time, lower pH values and higher levels of acidity, Al, Fe, and Mn were found at the 25- and 75-cm soil depths in the unlimed areas. When the soil was limed, the soil water at the 25-cm depth was nearly neutral or alkaline throughout the study and practically devoid of Al, Fe and Mn. At the 130-cm depth on both unlimed and limed areas the pH, total acidity, Al, Fe, and Mn of the soil water remained relatively unchanged even after 525 cm of acid water had been applied. Growth of ryegrass and tall fescue was not adversely affected by irrigation with the acid water, but was significantly increased by liming. Only the tall fescue yielded significantly more with increased levels of acid water irrigation.
W81-03012

METHOD AND APPARATUS FOR TREATING SEWAGE,
A. A. DeFraites.
U.S. Patent No 4,209,388, 10 p, 11 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1390, June 24, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Settling basins, Aerobic conditions, Anaerobic conditions, Algae, Biochemical oxygen demand, *Aerobic treatment.

Steps are disclosed in a method for the complete treatment of sanitary sewage comprising water containing suspended or dissolved organic matter, the concentrations of which is measured by biochemical oxygen demand (BOD). Effluent in a sewage treatment pond is uniformly disposed of through the use of a land area to upgrade the quality of effluent. The effluent flows over and through vegetation, with overflow upon a wide outer side of a levee or weir to form a thin film with maximum exposure to air and sunlight. A facultative waste stabilization pond capable of treating an amount and concentration of sewage per acre approximately doubles the quantity which

can be applied to an entirely aerobic treatment pond. Combined aerobic and anaerobic decomposition takes place without the drawbacks conventionally associated with anaerobic conditions. The process provides for aerobic treatment of sewage by action of algae in the upper level of the pond, followed by a removal of the algae in a second pond. (Sinha-OEIS)
W81-03018

MICROBIOLOGICAL METHOD FOR REMOVING PATHOGENIC MICROBES AND DISSOLVED ORGANIC MATERIALS FROM LIQUIDS,
K. H. Hartkorn.
U.S. Patent No 4,209,389, 4 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1390, June 24, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Organic wastes, Pathogenic bacteria, Electrochemistry, Microorganisms, Oxygenation, Nutrients, Kefir milk acid bacteria.

A method for removal of contaminating impurities from sewage and waste water liquid comprises the steps of subjecting the liquid to an electrochemical, electrocoagulation pretreatment to free the solids and colloidal-suspended matter; and adding to the pretreated liquid a seed from a Kefir milk acid bacterial microorganism culture. The seeded liquid is then passed over a column consisting of an antimagnetic stainless steel fabric in cylindrical shape and having a large surface area on which the Kefir seed of microorganisms deposits and forms a biological lawn. Atmospheric oxygen is supplied to the column and the lawn of Kefir microorganisms utilizes the bacterial contaminants as nutrient material and the liquid is freed of its contaminants. (Sinha-OEIS)
W81-03019

PROCESS FOR BIOLOGICAL DENITRIFICATION OF EFFLUENTS,
Produits Chimiques Ugine Kuhlmann, Paris (France). (Assignee).
B. Cabane, and J. Vergnault.
U.S. Patent No 4,209,390, 3 p, 17 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1391, June 24, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Denitrification, Biological treatment, Microorganisms, Flow, Fluidized bed reactors, Fixed beds.

The invention is directed to industrial waste waters and processes making it possible to reduce, at a high transformation rate, the concentration of nitric nitrogen, while minimizing the concentrations of carbon substrate necessary for denitrification. The process comprises making an active denitrification support formed of selected denitrifying bacteria and very fine calcium carbonate which surrounds a particle or support constituting the nucleus of a grain, for example, charcoal. The process is characterized by affixing a denitrifying flora, suited to a given exogenous substrate, on a solid support. Active denitrification supports obtained in this process can be used in any type of denitrification reactor, such as homogeneous, fixed bed or fluid bed reactors. The process is started by completely recycling the effluent charged with microorganisms. This recycling is necessary to permit induction of the denitrifying activity and to permit maximum fixation of the microorganisms on the support. (Sinha-OEIS)
W81-03020

METHODS FOR USE IN WATER PURIFICATION PARTICULARLY SEWAGE TREATMENT,
Filters International Inc., Chicago, IL. (Assignee).
E. B. White, and M. N. Sharma.
U.S. Patent No 4,209,396, 21 p, 11 Fig, 4 Tab, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1393, June 24, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Sewage treatment, Separation techniques, Tertiary treatment, Flocculation, Filtration, Adsorption, Activated carbon, Equipment, Regeneration.

A method and apparatus for treatment of sewage and waste materials is particularly desirable for relatively small family and multi-family installations and utilizes high rate bio-chemical oxidation/physio-chemical adsorption. The sewage is subjected to a primary biological treatment, and a secondary settling treatment. Following addition of an organic-inorganic chemical material comprising prereacted floc, a phosphate precipitating material and a nonionic polyelectrolyte, the effluent is subjected to a tertiary treatment by passage through a mixed filtration and adsorption bed containing activated carbon. The invention also provides fully automatic cyclic operation and includes a tertiary method and structure, including regeneration of the mixed bed, as well as the chemical materials. (Sinha-OEIS)
W81-03022

PROCESS FOR THE WORKING UP AND REGENERATION OF WASH WATERS CONTAINING AMMONIUM,
Deutsche Gesellschaft fuer Wiederaufarbettung von Kernbrennstoffen m.b.H., Hanover (Germany, F.R.). (Assignee).
H. Lahr, and G. Krug.
U.S. Patent No 4,209,399, 3 p, 5 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1394, June 24, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Industrial wastes, Organic wastes, Nuclear wastes, Heavy metals, Recirculated water, Water reuse, Ammonia, Regeneration.

This invention relates to a process for obtaining regenerated wash waters free of ammonium nitrate and organic substances, carbonate and heavy metals which can be reused, optionally after replenishment of the ammonium content, to wash out precipitated chemicals used for precipitation and by-products resulting from the production of nuclear fuel or breeder materials. The process for the regeneration of the loaded wash waters resulting from the production of hydrated oxide gels of actinides comprises evaporating the wash waters to a concentration of at least 900 grams per liter salt and scrubbing the resultant carbon dioxide-containing vapors prior to their condensation with hot alkali lye. It has been discovered in accordance with another embodiment of this invention that in a second vessel the inorganic and organic components can be removed from this residue by introducing concentrated nitric acid and thereafter heated to a temperature greater than 100C causing disintegration of ammonium nitrate and other impurities, especially organic impurities, into gases such as carbon dioxide, nitrogen, and nitrogen oxides which are filtered and washed to be released to the atmosphere. (Sinha-OEIS)
W81-03025

CLOSED LOOP WASTE TREATMENT AND WATER RECYCLING TOILET SYSTEM,
Thetford Corp., Ann Arbor, MI. (Assignee).
A. J. Coviello, F. E. Bernardin, and K. R. Kalb.
U.S. Patent No 4,210,528, 7 p, 1 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 231, July 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Water reuse, Water utilization, Impaired water use, Anaerobic conditions, Aerobic bacteria, Filtration, Disinfection, Adsorption, Closed loop system.

A closed loop waste treatment and water recycling system includes a delivery system, an anoxic reactor, an aerobic digestion chamber, a filtering system, an adsorption system, a disinfecting system and a water return system. The delivery system includes one or more flush-type toilets and urinals which receive flush water from the water return system and deliver the toilet and urinal waste and flush water to the anoxic reactor. The anoxic reactor contains bacteria which utilizes organics to convert oxidized nitrogen compounds to nitrogen gas, produce bicarbonates etc. A denitrified liquid containing bicarbonates and reduced amounts of organics is transferred to the aerobic digestion chamber, which contains biologically active solids and in which organic carbon, organic nitrogen, and ammonium compounds are oxidized by bacteria to obtain a liquid product high in concentration of oxidized nitrogen compounds such as nitrates and low in soluble carbonaceous compounds. This liquid product is filtered, treated with activated carbon, disinfected, and subsequently returned to the toilets and urinals as colorless, clear and odorless flush water containing oxidized nitrogen compounds. The nitrogen compounds produced in the aerobic digestion chamber insure prevention of odors in the system. As a result of the effective management of nitrogen in the system, it can be made of reasonable size, undesirable odors are avoided and a desired slower buildup of solids in the system is achieved. (Sinha-OEIS)
W81-03030

TREATMENT OF METAL PLATING WASTES WITH AN UNEXPANDED VERMICULITE CATION EXCHANGE COLUMN,
Purdue Research Foundation, Lafayette, IN. (Assignee).
J. E. Etzel, and V. Keramida.
U.S. Patent No 4,210,530, 8 p, 9 Tab, 6 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 232, July 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Separation techniques, Industrial wastes, Heavy metals, Cation exchange, Ion exchange, Water reuse, Vermiculites, Metal plating industry, Cyanides, Product recovery.

Multivalent heavy metal ions are removed from metal plating waste streams by passing them through an unexpanded vermiculite cation exchange column. The column is effective to remove copper, zinc, and nickel ions and mixtures thereof. Where cyanide and cyanide-metal complexes are also present in the plating waste stream, the stream is pretreated to destroy the cyanide and cyanide complexes prior to passage through the ion exchange column. (Sinha-OEIS)
W81-03031

WATER CONDITIONER ROTARY VALUE STRUCTURE,
H. L. Loke.
U.S. Patent No. 4,210,532, 10 p, 17 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 232-233, July 1, 1980.

Descriptors: *Patents, *Water treatment, *Water softening, Valves, Equipment, Brines, Water quality control, Demineralization, Backwashing.

A combined closure and rotary water valve assembly prvides for closing the upper end of a water softener mineral tank. It is used in conjunction with a brine water tank including a float valve controlled brine water outlet and water supply line from the brine tank to the valve assembly. The valve assembly comprises a four position, five function value. The five functions of the valve include a service function during which hard water enters the mineral tank and is softened and is thereafter discharged from the tank, a backwash function during which the bed of minerals within the tank is backwashed, a brine function in which brine is flushed through the mineral bed, a slow rinse function for flushing the brine from the mineral bed, and a combined rapid rinse and the supply of water within the brine tank is replenished. These five functions of the valve assembly are sequentially performed as a result of a rotary actuator of the valve assembly being sequentially angularly advanced in one direction of rotation. (Sinha-OEIS)
W81-03032

MULTIPLE STAGE JET NOZZLE AND AERATION SYSTEM,
Clevepak Corp., White Plains, NY. (Assignee).
A. E. Molvar.

U.S. Patent No 4,210,534, 8 p, 4 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 233, July 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Aeration, Mixing, Turbulence, Bubbles, Jets, Nozzles, Equipment.

An improved system for mixing gas with waste water is described in which the water is pumped through nozzles or vortex mixing chambers into which the gas is injected at a step region to form parallel streams of gas and water. The multiple stage nozzle includes an extending chamber which contains the parallel streams as the interface between them becomes unstable, breaks down creating vortices and produces tiny bubbles which mix with the water. The extending chamber is divided into three sections or stages with at least one section tapered inwardly at a rate of 11C-22C to permit operation at higher air flow rates without loss of efficiency and the outermost section from which the mixed stream is directly discharged into the body of waste water being non-diverging, preferably cylindrical. (Sinha-OEIS)
W81-03034

MANUAL FOR WATER RENOVATION AND RECLAMATION,
National Inst. for Water Research, Pretoria (South Africa).
Technical Guide K42, UDC 628.315, (1978), 318 p, 76 Fig, 54 Tab, 239 Ref, 4 Append.

Descriptors: *South Africa, *Waste water renovation, *Water reuse, *Standards, *Water reclamation, Water conservation, Clarification, Chlorination, Activated carbon, Water treatment facilities.

Extensive investigations by the National Institute for Water Research in South Africa over the past 10 years were used to develop guidelines for design engineers, researchers, and organizations concerned with the reclamation of water from waste water. The large-scale operation at the Stander water reclamation plant and laboratory and pilot scale investigations were used for much of the background. Unit processes used in reclamation include: high lime treatment, ammonia stripping, softening, quality equalization, stabilization, filtration, active carbon adsorption and regeneration, sludge handling, and disinfection using chlorination and ozonation. The manual gives attention to the feasibility and economics of each of the unit processes along with the basic engineering guidelines for each process. The manual will be updated in the future and will be supplemented by a guide to planning, design, and operation of water reclamation plants. (See W81-03038 through W81-03051) (Seigler-IPA)
W81-03037

AN INTRODUCTION TO WATER RENOVATION AND RECLAMATION,
National Inst. for Water Research, Pretoria (South Africa).
O. O. Hart.
In: Manual for Water Renovation and Reclamation CSIR Technical Guide K42, p 1-16, (1978). 1 Fig, 5 Tab, 14 Ref.

Descriptors: *South Africa, *Waste water renovation, *Water reuse, *Water conservation, Clarification, Chlorination, Ozonation, Filtration, Waste water treatment, Sludge drying, Activated sludge, Water quality, Water treatment, Water treatment facilities.

A supply of fresh surface water for all consumers is no longer possible in a water-poor country such as South Africa, therefore, water renovation and reclamation, two methods of conserving the water that is available, are becoming increasingly necessary. Successful reuse of waste water has been achieved in locations such as Lake Tahoe in South Africa, Chanute in the United States, and Windhoek in South West Africa. Research that began six years ago at the Stander water reclamation plant, Daspoort, Pretoria has done much to futher water reuse in South Africa. The research has dealt primarily with two types of raw water, biofilter humus tank effluent and activated sludge effluent. Unit processes have been developed so that final water of virtually any quality can be produced. Unit processes used include: lime treatment, clarification, quality equalization, ammonia stripping, recarbonation, sand filtration, chloride disinfection, ozone disinfection, active carbon adsorption, final treatment, sludge dewatering, and active carbon regeneration. The cost of renovated and reclaimed water is a function of plant size, waste water characteristics, and the degree of treatment ore renovation. The most expensive, but necessary, unit process is active carbon adsorption, while the most economical unit process is quality equalization. (See also W81-03037) (Seigler-IPA)
W81-03038

CLARIFICATION,
National Inst. for Water Research, Pretoria (South Africa).
M. Ronen.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 17-44, (1978). 1 Fig, 7 Tab, 16 Ref.

Descriptors: *South Africa, *Clarification, *Waste water renovation, *Waste water treatment, Chemical precipitation, Water treatment, Lime, Activated sludge, Water treatment facilities, Design criteria, Evaluation, Effluents, Water quality, Advanced waste water treatment, Water reuse.

Lime clarification was used at the Stander water reclamation plant in Daspoort, Pretoria, South Africa, to study the effectiveness of the treatment, and to develop design guidelines for the process. Lime clarification is used to: (1) remove suspended and colloidal matter and some dissolved organic matter, (2) precipitate phosphorus and heavy metals, and (3) raise the pH for later ammonia removal. Lime clarification comprises three consecutive steps: coagulation, flocculation, and phase separation. Stander's clarification system has a lime reactor where the influent is mixed with lime slurry under controlled pH conditions. Next an upflow clarifier with a concentric, conical flocculation chamber, separates the effluent from the sludge. The sludge is then drawn off to be dewatered. The Stander plant has treated both biofilter humus tank effluent and activated sludge effluent. Techniques for lime dosage requirements, clarifier size determination, and screening tests for coagulant aids have been developed to aid in the evaluation of design parameters. Factors to be considered in the evaluation of process efficiency include: inorganic components, stability, clarity, nutrient removal, effect on micro-organisms, removal of trace elements, and organic matter. Design and general plant consideration are also discussed. (See also W81-03037) (Seigler-IPA)
W81-03039

QUALITY EQUALIZATION,
National Inst. for Water Research, Pretoria (South Africa).
B. M. van Vliet.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 45-60, (1978). 10 Fig, 2 Tab, 11 Ref.

Descriptors: *Water quality, *South Africa, *Equalizing basins, *Water renovation, *Waste water treatment, Chlorination, Chemical precipitation, Effluents, Lime, Ammonia, Water treatment facilities, Hydrogen ion concentration, Water reuse, Scaling, Corrosion.

A surface-aerated equalization pond installed at the Stander water reclamation plant at Daspoort, Pretoria, SA, was highly effective in reducing fluctuations in water quality. Factors affecting the quality of effluents include: the quality and variability of the original raw sewage, the type of sewage treatment system, ambient temperature and climatic changes, and concentrations of inhibitory substances. Mechanisms that are responsible for creating such conditions are the reduction of a particular constituent during treatment and the degree of mixing at various stages in the treatment. Prior to the construction of the equalization pond, the Stander plant had problems with the control of breakpoint chlorination due to fluctuations in quality. The equalization pond was constructed between the high lime process and the ammonia stripping tower. Advantages produced by the pond include: ammonia desorption at a high pH, minimized scale formation in the ammonia stripping tower due to a reduction in calcium carbonate supersaturation, and the creation of a microbiological barrier at high pH. Both subsurface and surface aeration of the pond were evaluated. Equalization pond design and equipment considerations are discussed. (See also W81-03037) (Seigler-IPA)
W81-03040

AMMONIA STRIPPING,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. van Vuuren.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 63-77, (1978). 12 Fig, 5 Tab, 9 Ref.

Descriptors: *Ammonia, *Water renovation, *South Africa, *Waste water treatment, Chlorination, Scaling, Effluents, Seasonal variation, Stripping towers, Sewage treatment, Water quality control, Humidity, Humus sludge, Economic efficiency.

Experiences with a multi-stage, cross-flow ammonia stripping tower at the Stander water reclamation plant in South Africa were used to develop design guidelines for ammonia stripping in water renovation and reclamation plants. It is economically important to reduce ammonia concentrations to low levels prior to chlorination due to the high chlorine demand associated with ammoniacal nitrogen. Ammonia stripping is particularly needed for the reclamation of humus tank effluent from biological filtration plants due to extreme diurnal and seasonal quality variations. The stripping tower studied consisted of a galvanized steel shell with saligna wooden slats as packing material. The slats were assembled in trays to form six packing modules. There was air intake through each individual module. Ammonia removals of up to 90% were achieved with the tower. Best performance levels were achieved during periods of high humidity such as the rainy season. Winter dropped the stripping efficiency to about 50%. Stripping tower design parameters requiring particular attention include: efficient air and water distribution, type of packing used and total surface area, the air to water ratio which should be between 2,000 and 3,000 to 1, and the hydraulic loading. (See also W81-03037) (Seigler-IPA)
W81-03041

SOFTENING AND RECARBONATION,
National Inst. for Water Research, Pretoria (South Africa).
J. van Leeuwen, and H. N. S. Wiechers.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 79-99, (1978). 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Water renovation, *Water quality control, *Water softening, *Recarbonation, Hydrogen ion concentration, Lime, Calcium, Magnesium, Scaling, Chemical precipitation, Chlorination, Hardness, Caldwell-Lawrence diagrams, Alkalinity, Acidity, Waste water treatment, *South Africa.

Lime softening, the chemical or physical removal of calcium and magnesium ions from water, and recarbonization, the addition of carbon dioxide to lower pH, are effective methods for achieving a specified water hardness objective in water reclamation processes. In designing a water softening scheme, five water characteristics must be measured or determined: temperature, total dissolved solids, calcium hardness, pH, and alkalinity or acidity. Once some of these parameters have been determined, a modified Caldwell-Lawrence diagram can be used to plot the data and experimentally determine the needed softening values. Caldwell-Lawrence diagrams can also be used to determine magnesium removal values. Lime and carbon dioxide are the two most commonly used softening chemicals. Equipment needed for softening in-

cludes: dosing instruments, reactors, settlers, a water transport system, and a means of drawing off sludge. Lime can be conveniently dosed as a slurry or a solution, while carbon dioxide can either be produced by burning hydrocarbons or purchased in a bottle. Extra caution is necessary when handling and storing bulk carbon dioxide due to the high pressure of the storage vessels. Placing the softening process units close together will minimize labor when descaling the transport system. A gravity water transport system saves on operational costs and reduces descaling and general maintenance. (See also W81-03037) (Seigler-IPA)
W81-03042

FILTRATION,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. van Vuuren.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 101-114, (1978). 2 Fig, 5 Tab, 8 Ref.

Descriptors: *Filtration, *Water treatment, *Waste water treatment, *Water renovation, *Filters, Gravity filters, Sand filters, Filter media, Filter rate, Filtered waste water, Potable water, Pressure filters, Suspended solids, Disinfection, *South Africa.

Filtration, a commonly applied process in water treatment, has become increasingly important in the production of potable water due to the current emphasis on water renovation and reclamation. The mechanism of filtration is complex and consists of a number of different processes: straining, sedimentation, flocculation, adsorption, and biological activity. These processes vary in predomination and effect the removal of suspended impurities in combination with one another. Roughing filters are used for partial removal of suspended matter or as a pretreatment stage. Terminal filters are used after pretreatment for the production of final water. A direct filter produces final water without pretreatment or coagulants. Three basic types of filters are most commonly used: slow sand filters, rapid gravity filters, and mixed media filters. New developments in filtration include: upflow, biflow, and radial flow filters; improved control techniques; and dual and multi-media filtration. Process parameters and equipment consideration needed when designing a filtration system include: (1) pressure filters must be lined to prevent chlorine corrosion, (2) level control is needed to prevent surging problems, (3) stand-by equipment is needed, (4) backwash water and controlled backfeed must be balanced, and (5) pneumatically controlled valves are recommended. Open gravity concrete filters are preferred due to ease of control and maintenance. (See also W81-03037) (Seigler-IPA)
W81-03043

CHLORINE DISINFECTION,
National Inst. for Water Research, Pretoria (South Africa).
J. van Leeuwen.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 115-130, (1978). 4 Fig, 18 Ref.

Descriptors: *Water renovation, *Chlorination, *Waste water treatment, *Disinfection, *Ammonia, Water treatment, Potable water, Pathogens, Diseases, Ammonia stripping, Breakpoints, Contactors, Oxidation, Nitrogen, Nitrogen compounds, Chlorinated hydrocarbons, *South Africa.

Chlorine, the most commonly used disinfectant for water renovation and reclamation, is highly effective when administered in sufficient dosages, however, overdosing leads to unnecessary expense for chlorine and for the chemicals used in final treatment. Dosage requirements depend mainly on the concentration of substances such as nitrogen compounds like ammonia, rather than on the type or quantity of micro-organisms to be inactivated. Chlorine dosages must be sufficient to oxidize the nitrogen compounds and still leave a residual concentration of chlorine strong enough to inactivate pathogens. Other factors that may hamper chlorine disinfection include turbidity, alkalinity and hardness, and the formation of chlorinated hydrocarbons that may be toxic or carcinogenic. To economize on chlorine consumption and to limit the formation of unwanted by-products, conditions must be controlled so that ammoniacal nitrogen can be economically oxidized to nitrogen gas. An ammonia stripping tower can be used prior to chlorination to remove some of the nitrogen, however, this is expensive and cannot remove all of the ammonia, therefore chlorine must still be applied to breakpoint for disinfection to be achieved. Steps in designing a disinfection unit include: determining the dosage required, calculating the capacity of the dosing equipment, providing suitable dosage control, and designing a contacting reactor with sufficient retention time and an appropriate flow pattern. (See also W81-03037) (Seigler-IPA)
W81-03044

OZONE DISINFECTION,
National Inst. for Water Research, Pretoria (South Africa).
J. van Leeuwen.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 131-144, (1978). 6 Fig, 16 Ref.

Descriptors: *Ozonation, *Ozone, *Water treatment, *Disinfection, *Water renovation, Contactors, Chlorine, Chlorination, Cost analysis, Economic aspects, Generators, Turbidity, Ammonia, Carbon adsorption, *South Africa.

Despite drawbacks such as a relatively high cost when compared to chlorine, ozone is rapidly gaining popularity as a disinfecting agent in water renovation and reclamation. Advantages include improved taste and color, and high ozone dosages are not detrimental to water quality in terms of total dissolved solids and pH. Ozone, an allotropic form of oxygen, is poorly soluble which often leads to only partial utilization. Due to the instability of ozone, on-site generation is imperative. Like chlorine disinfection, turbidity, ammonia, organic compounds, alkalinity and hardness can interfere with ozone disinfection. A packed or tray column or a spray tower are needed to provide a constant surface renewal of water and a long retention of the gas phase for ozone disinfection. Spray towers have a high energy consumption, while tray columns, the most effective contactors, are relatively expensive and difficult to construct. An active carbon adsorption unit should always follow ozonation to adsorb any harmful oxidation products. Also, ozone demand can be reduced 60-70% by ozoning after primary active carbon adsorption. Economically, the break-even point for using ozone rather than chlorine comes at an ozone demand of less than 50% of the chlorine demand, if all other costs remain equal. Equipment needed for ozonation includes: an absorber, a reactor, process controls, pumps, an ozone generator, and safety controls. (See also W81-03037) (Seigler-IPA)
W81-03045

ACTIVE CARBON ADSORPTION,
National Inst. for Water Research, Pretoria (South Africa).
B. M. van Vliet.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 145-170, (1978). 4 Fig, 2 Tab, 27 Ref.

Descriptors: *Water renovation, *Activated carbon, *Adsorbents, *Water treatment, *Water quality control, Contactors, Waste water treatment, Organic compounds, Heavy metals, Chromium, Cadmium, Mercury, Hydrogen ion concentration, Water reuse, *South Africa.

Active carbon is used in water reclamation for the adsorption of dissolved organic compounds and heavy metals such as hexavalent chromium, mercury, and cadmium. Organic compounds adsorbed onto active carbon include: aromatic hydrocarbons, polynuclear aromatics, chlorinated phenolics, ketones, esters, alcohols, surfactants, soluable organic dyes, and others. Active carbon has a large surface area and a relatively neutral nature, making it particularly useful for adsorbing non-polar hydrophobic substances. Factors affecting adsorption efficiency include: pore size distribution, nature and concentration of the solute, temperature and pH of the solution, and the characteristics of the contacting system. The contacting system may be either a granular or powdered carbon system. Powdered systems are based on once-through, powder-water contacting and subsequent separation. Granular carbon systems are of the columnar type with various modes of operation. Three modes of operation are possible: countercurrent moving bed, expanded-bed upflow, and fixed-bed downflow. The type of active carbon used is determined by: the iodine number, apparent density, particle size distribution, and abrasion resistance. Various general approaches to process design for adsorption have been developed to yield the critical process parameters. (See also W81-03037) (Seigler-IPA)
W81-03046

SLUDGE DEWATERING,
National Inst. for Water Research, Pretoria (South Africa).
M. Ronen.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 171-189, (1978). 10 Fig, 5 Tab, 10 Ref.

Descriptors: *Dewatering, *Sludge drying, *Sludge thickening, *Water renovation, *Waste water treatment, Water reuse, Centrifugation, Lime, Separation techniques, Sludge solids, Settleable solids, *South Africa, Sedimentation, Sludge cakes.

Experiences with centrifugal dewatering of lime sludge at the Stander water reclamation plant in South Africa were used to develop guidelines for sludge dewatering. Dewatering reduces the volume of the sludge and forms it into cakes which can be easily handled or treated further. A centrifuge enhances solids-liquid separation by rotating the sludge at a high speed to subject the solids to an increased gravitational force. The continuously discharging solid-bowl decanter centrifuge is especially well suited for dewatering lime sludge. It has a solid, cylindrical shell supported between two bearings. A screw conveyor in the shell is rotated at a slightly different speed from the shell to move the sludge through. Heavier solids separate out first, then the finer solids. Both machine variables and process variables influence the performance of the centrifuge. Dewatering performance is usually expressed as cake dryness, centrate clarity, and percentage of solids recovery. Two main scale-up (or scale-down) methods, the sigma concept and the beta concept, can be used to compare similar centrifuges for performance evaluation. Also, a mathematical model for describing centrifugal sludge dewatering has been developed. Some advantages of centrifugal dewatering over other mechanical dewatering systems are: it is a totally enclosed, simply operated system, it has great operational flexibility, and it can be used without the addition of chemicals. An economic evaluation is included. (See also W81-03037) (Seigler-IPA)
W81-03047

CARBON REGENERATION,
National Inst. for Water Research, Pretoria (South Africa).
B. M. van Vliet.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 191-206, (1978). 6 Fig, 3 Tab, 35 Ref.

Descriptors: *Water renovation, *Activated carbon, *Adsorbents, *Regeneration, Furnaces, Pyrolysis, Oxidation, Dewatering, Waste water treatment, *South Africa, Water reuse, Water treatment, Combustion.

A multi-hearth furnace regeneration system is used at the Stander water reclamation plant in South Africa to regenerate spent carbon so that it will be available for repeated cycles of application. The process is needed to make granular active carbon treatment economically feasible for water reclamation purposes. The Stander furnace has seven

hearths and the carbon is transported through the system hydraulically. A conveyor feeds spent carbon into the top hearth where it is dewatered to about 45% water. Next the carbon goes through the lower hearths and into the quench tank. The four stages comprising carbon regeneration are: (1) drying of the spent carbon, (2) vaporization of the volatile adsorbates, (3) pyrolysis of the non-volatile adsorbates, and (4) oxidation of the pyrolized adsorbates. For process design purposes and for determining the size of furnace needed, data must be collected on the carbon exhaustion rate and the carbon loading rate. Furnace module equipment and fixtures needed for carbon regeneration include: refractories, rabble arms, inspection doors, steam supply points, a dewatering screw, an exit chute, a quench tank, combustion equipment, an after burner, a scrubber, a stack, carbon storage tanks, and control equipment. (See also W81-03037) (Seigler-IPA)
W81-03048

FINAL TREATMENT,
National Inst. for Water Research, Pretoria (South Africa).
J. van Leeuwen.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 207-220, (1978). 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Corrosion control, *Scaling, *Fouling, *Microorganisms, *Water treatment, Corrosion, Pipes, Distribution systems, Hydrogen ion concentration, Sequestrants, Chlorination, Disinfection, Coatings, Chemical precipitation, Water temperature, *South Africa.

Prior to distribution water should be treated to reduce corrosion, encrustation, and bacterial and fungal growth in water mains and distribution systems. In South Africa many systems have lost 50% of their carrying capacity due to these problems. The corrosiveness of water depends on the type of pipe, the concentration and nature of the solutes, and the pH and temperature of the water. Corrosiveness can be reduced by adjusting the pH or through the addition of chemicals. Iron pipes can be coated or cladded to protect them from corrosion. Coatings can be formed through precipitation from the water to give a self-forming or self-healing film. Excessive scale formation can be inhibited by adding sequestrants to the water. The addition of a disinfectant to the final water provides a residual to inhibit the growth of microorganisms which may be a health hazard and can be a nuisance in distribution systems. Excessive chlorine disinfection should be avoided as it leads to increased corrosion. Three examples of control strategies as they apply to water of different chemical qualities are given. (See also W81-03037) (Seigler-IPA)
W81-03049

OPERATIONAL GUIDELINES,
National Inst. for Water Research, Pretoria (South Africa).
O. O. Hart.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 221-257, (1978). 3 Fig, 9 Tab, 7 Ref.

Descriptors: *Water renovation, *Operating policies, *Administration, *Water treatment facilities, *Control systems, Monitoring sampling, Manuals, Maintenance, Personnel, Personnel management, Waste water treatment, *South Africa, Safety.

For a water reclamation plant to operate successfully, attention must be given to operational and control aspects. Operational aspects encompass the orderly running of the plant, monitoring, and maintenance, while control aspects deal with the mode of control needed to produce a reliable product. A plant control manual, a maintenance manual, and qualified operating personnel are all essential to successful operation. The Stander water reclamation plant in South Africa has operated successfully for years and provides a good illustration of the important aspects of operation and control. Objectives must be determined for each unit process and should be followed by parameter limits and control procedures. Hourly determination of these key parameters should be used to control within narrow limits. Visual observation by operating personnel is valuable in the production of a fail-safe product. Correct and sufficient instrumentation for both operation and control is vitally important. Meticulous record keeping and frequent sampling should be checked by the superintendent. At least two barriers are recommended for each contaminant. Of major importance are the plant operators who should be enthusiastic and should be sufficiently trained. (See also W81-03037) (Seigler-IPA)
W81-03050

HEALTH ASPECTS,
National Inst. for Water Research, Pretoria (South Africa).
W. H. J. Hattingh.
In: Manual for Water Renovation and Reclamation, CSIR Technical Guide K42, p 259-283, (1978). 13 Tab, 52 Ref.

Descriptors: *Potable water, *Water quality, *Water renovation, *Water reclamation, World Health Organization, *South Africa, Disinfection, Diseases, Human diseases, Infection, Pathology, Safety, Water treatment, Microbiology, Bioassays.

Chemical, microbiological, and bioassaying techniques have been used to study the quality of the constituents in municipal waste waters, water reclaimed from secondary effluents, and other waters. Experiments using rats, fish, and microorganisms have been used to study the long-term effects of possible pollutants. Microbiological quality was determined by methods and counts such as: a total bacterial plate count, a total coliform count, a fecal coliform count, confirmed E. Coli I, faecal streptococci, Clostridium perfringens, and others. While attempts have been made to determine norms for the chemical quality of water, no standards exist due to the lack of knowledge about organic compounds present in water. The quality of water produced at the Stander water reclamation plant in South Africa was compared to drinking-water standards proposed by the World Health Organization. The chemical and microbiological quality of the water reclaimed by the plant was satisfactory and the water should have no adverse effect on the health of consumers. Bioassays with rats and fish showed no deleterious effects. This comparison leads to the conclusion that reclaimed water does not present a health hazard. (See also W81-03037) (Seigler-IPA)
W81-03051

WATER REUSE: PROJECTING MARKETS AND COSTS,
Orange-Los Angeles Counties, CA. Water Reuse Study.
For primary bibliographic entry see Field 3C.
W81-03072

THE EPA VALUE ENGINEERING PROGRAM: PART II,
Culp/Wesner/Culp, Cameron Park, CA.
For primary bibliographic entry see Field 6A.
W81-03082

PURIFICATION AND RECLAMATION OF FARM AND URBAN WASTES BY EUGLENA GRACILIS: PHOTOSYNTHETIC CAPACITY, EFFECT OF PH, TEMPERATURE, ACETATE AND WHEY,
Manitoba Univ., Winnipeg. Dept. of Botany.
E. R. Waygood, A. Hussain, H. R. Godavari, Y. C. Tai, and S. S. Badour.
Environmental Pollution (Series A), Vol 23, No 3, p 179-215, November, 1980. 18 Fig, 8 Tab, 22 Ref.

Descriptors: *Water reuse, *Farm wastes, *Waste treatment, *Euglena gracilis, Hydrogen ion concentration, Temperature, Sewage, Nutrient, Growth, Aquiculture.

A study was conducted to define the conditions under which Euglena gracilis would grow without predation and deplete wastes of dissolved inorganic nitrogen and phosphate. E. gracilis was grown on sewage or abattoir waste or in ponds with swine manure digest. At pH 4.0 the Euglena grew in almost a monoculture. At pH 7.0 Euglena grew initially,. but succumbed to bacterial invasion and was succeeded by chlorophytes. Acetate enhanced the growth. However, neither acetate nor other low molecular weight compounds was able to induce sufficient growth of Euglena to completely deplete the media of ammonia and orthophosphate. The development of an amoeba at pH 4.0 also stopped growth. Whey suppressed the development of amoebas and provided nutrients and growth substances such as vitamins. Harvesting was made easier by the phototactic responses of Euglena, which rise to the water surface in dim sunlight. The residual water after depletion of ammonia-nitrogen and phosphate-phosphorus can be readily neutralized and used for aquaculture or recycling. The algae may be useful as a feedstuff or a fertilizer. The process is potentially suitable for use on small farms. (Baker-FRC)
W81-03090

EFFECT OF HARDWOOD CHLORINATION CONDITIONS ON THE FORMATION OF TOXIC CHLORINATED COMPOUNDS,
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
R. H. Voss, J. T. Wearing, and A. Wong.
Tappi, Vol 64, No 3, p 167-170, March, 1981. 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Chlorination, *Bleaching wastes, *Pulp and paper industry, Phenols, Hardwood, Waste water treatment, Industrial wastes, Chlorine dioxide, Wastes, Effluents, Toxicity, Aromatic compounds, Organic compounds.

Hardwood kraft pulp chlorination conditions were studied to minimize formation and waste water discharge of low-molecular weight chlorinated phenolic compounds toxic to fish. Among the compounds formed in the conventional chlorination-extraction bleaching process were chlorophenols, chloroguaiacols, chlorocatechols, chlorovanillins, chlorosyringaldehydes, and chlorosyringols. Varying chlorine dosages from 50 to 150% of demand showed that the maximum amounts of chlorinated phenols were formed at 80% of demand. Chlorovanillins were more prevalent at lower Cl doses, and chloroguaiacols at higher doses. Increasing pH produced a reduction in chlorinated phenolics. Chlorination temperature, whether 25 or 60C, had little effect on amount and nature of chlorinated phenols produced. When chlorine dioxide-chlorine mixtures were used, chlorinated phenolics formation reached a maximum at 50% ClO2 substitution. No chlorinated phenolics were present in effluent when 100% ClO2 was used. Although substantial substitution of ClO2 for Cl2 and a higher end pH produced a less toxic effluent, pulp viscosity decreased considerably. (Cassar-FRC)
W81-03096

RATES OF MICROBIAL TRANSFORMATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN WATER AND SEDIMENTS IN THE VICINITY OF A COAL-COKING WASTE WATER DISCHARGE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. E. Herbes.
Applied and Environmental Microbiology, Vol 41, No 1, p 20-28, January, 1981. 6 Fig, 1 Tab, 27 Ref.

Descriptors: *Organic compounds, *Biodegradation, *Polycyclic aromatic hydrocarbons, *Synthetic fuels, *Coal industry, Microorganisms, Waste water treatment, Bacteria, Sediments, Water pollution, Degradation(Decomposition), Chemical wastes, Hydrocarbons.

Rates of microbial transformation of polycyclic aromatic hydrocarbons (PAH) were measured in stream water and sediment samples from a coal-coking waste water discharge during the period November 1977-August 1979. This work was done to obtain information applicable to waste water treatment in future plants converting coal to synthetic fuels. Six C14-labeled PAH were incubated

in sediment and water samples. In sediment samples the major transformation product was nonextractable bound C14: this accounted for 90% in the case of anthracene; greater than 50% with benzo(a)pyrene, dibenz(a,h)anthracene, and dimethyl benz(a)anthracene; and about 50% with naphthalene and benz(a)anthracene. The other major product was C14O2. In contrast to sediment assays, incubated water samples produced soluble polar C14 transformation products--anthracene, 82%. Mean rate constants in sediment collected downstream from the effluent outfall were 0.078 per hour for naphthalene, 0.016 per hour for anthracene, and 0.0033 per hour for benz(a)anthracene. Benzo(a)pyrene and dibenz(a,h)anthracene did not show transformation. In water samples, anthracene and naphthalene were transformed; rate constants were 5 to 20 times lower than in sediments. After the effluent was diverted from the area in July 1978, the microbial transformation rates did not change, indicating that the microbial population changes very slowly. (Cassar-FRC)
W81-03131

COMPOST FILTERS FOR H2S REMOVAL FROM ANAEROBIC DIGESTION AND RENDERING EXHAUSTS,
Auckland Farmer's Freezing Co-operative Co., Ltd. (New Zealand). Central Lab.
M. B. Rands, D. E. Cooper, C-P. Woo, G. C. Fletcher, and K. A. Rolfe.
Journal of the Water Pollution Control Federation, Vol 53, No 2, p 185-189, February, 1981. 2 Fig, 5 Tab, 5 Ref.

Descriptors: *Odor control, *Meat processing industry, *Filters, *Waste water treatment, Sludge, *Waste disposal, Anaerobic digestion, Pilot plants, Carbon, Nitrogen, Hydrogen sulfide, Composting.

The Moerewa Meat Waste Treatment Plant has had problems with the disposal of anaerobic digester gas for the past 20 years. The plant produces an abundance of compost from the periodic removal of sludge from anaerobic solids, balancing tanks, and anaerobic digesters. Pilot plant compost filters for removing waste gases were set up to examine the suitability of such a system to remove odors, especially H2S, and to explore the possibilities of using similar equipment as an alternative to expensive odor control methods. Favorable pilot plant results led to the construction of full-scale compost filter plants in 1978. By 1979, most of the problems had been overcome and the filter was handling the full gas flow from the aerator. An analysis of the screened compost showed it had a bulk density of 0.813 kilograms/liter, and composition values of moisture 45.5%, nitrogen 0.81%, carbon 36.7%, and ash 33.9%, respectively. The average pH of the compost was 7.82, and the carbon/nitrogen ratio was 45.4. Watering was also instituted to prevent channeling and drying out of the compost and cracking of the retaining walls which gave rise to small leaks. (Geiger-FRC)
W81-03133

A DISPOSAL-COSTING METHOD FOR EVALUATING SLUDGE DEWATERING CHEMICALS,
Allegheny County Sanitary Authority, Pittsburgh, PA.
M. A. Flamang, and A. A. Martire.
Journal of the Water Pollution Control Federation, Vol 53, No 2, p 162-166, February, 1981. 5 Fig, 3 Tab, 1 Ref.

Descriptors: *Sludge drying, *Cost analysis, *Polymers, *Waste water treatment, Sludge treatment, Sludge disposal, Dewatering, Evaluations, Pilot plants, Simulation analysis, Mathematical studies, Sludge filters, Economic aspects.

A method for evaluating polymer performance in sludge dewatering was developed by the Allegheny County Sanitary Authority of Pennsylvania. The authority operates a secondary treatment plant which handles waste water from Pittsburgh and its suburbs. The theory behind the new evaluation procedure was developed to determine what additional costs the authority will incur as a result of differing performances of various sludge dewatering chemicals. Pilot plant trials were designed to simulate conditions of actual use. During the trials, one chemical system feeds the test product to designated filters, while another system feeds a control product to identical filters. A performance characteristic for each polymer tested was determined using the polymer dose and yield. The performance characteristic was utilized to alter the bid price to represent the actual product cost. The estimated effect of test cake moisture plus the polymer cost were used to calculate the annual sludge disposal cost. The disposal cost is used as a basis for determining which polymer supplier will be used. (Geiger-FRC)
W81-03136

AWT OPERATING PROCEDURES,
Greeley and Hansen, Chicago, IL.
E. T. Wilson, E. D. Lukasik, and W. D. Koepsel.
Water/Engineering and Management, Vol 128, No 1, p 48-52, January, 1981. 5 Fig, 7 Ref.

Descriptors: *Waste water treatment, *Quality control, Microbiological studies, Water treatment, Ammonia, Microorganisms, Computers, Water pollution control, Sludge, *Illinois, Lake County.

Control procedures are discussed for the two-step air activated sludge system in operation at the North Shore Sanitary District plant in Lake County, Illinois. Control is separated into the two major areas of control of the microbiology and control of the biosolids distribution. The object of microbiology control is to ensure that the right kinds of microorganisms are present in the mixed liquor, which will ensure good settling, good BOD5 and SS removal and good nitrification. In this district a computer-assisted control system is used for remote solids probes and flow sensors in real-time based on an SRT model. Each of the plants in the North Shore Sanitary District has a set of control procedures to take care of its own specific needs. Microbiology is controlled chiefly through sludge wasting. Microscopic examination, DO, pH and effluent ammonia tests are used to ensure good microbiology. Routine control of biosolids distribution is achieved through the centrifuge number and a specially developed ISV test which gives the operator quantitative information about how much capacity the plant has, and allows for objective determination of action needed to improve capacity. Various problems including filamentous bulking, toxics, recycle streams, stormwater flows, and others have been met through these measures. (Baker-FRC)
W81-03138

POOR SLUDGE SETTLEABILITY CAUSED BY THE BACTERIUM LAMPROPEDIA,
Wisconsin Univ.-Madison. Lab. of Hygiene.
J. H. Standridge.
Water/Engineering and Management, Vol 128, No 1, p 41, 44, 84, January, 1981. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Industrial wastes, *Bacteria, Cheese manufacturing, Settling basins, Sludge, Sludge lagoons, Lagoons, Digestion, Sludge digestion, Anaerobic digestion, Clarification, *Waste water treatment.

Poor sludge settleability is usually attributed to one or both of two major causes: a large number of organisms with a specific gravity of less than one, or a large number of filamentous organisms which physically maintain the floc in a dispersed condition, causing poor compaction. This plant suffered an unusual floating sludge problem and solved it by incorporating an aerated lagoon to pretreat cheese-factory wastes. A study is reported of a combined activated sludge-trickling filter sewage treatment facility with a history of repeated, severe clarifier settling problems. The plant operates a 1 MGD sewage treatment facility serving a population of 4500. The major industrial contributor is a large cheese processing company. Based on findings in the unusual floating sludge at the plant, the cheese factory was requested to pretreat its wastes to decrease the high BOD of the waste being discharged to the plant. The pretreatment system was equipped with a lagoon and four floating aerators triggered by preestablished dissolved oxygen levels. The addition of the lagoon pretreatment system improved plant performance in that the BOD in the final effluent was reduced from a range of 200-400 mg/liter to 10-30 mg/liter. Suspended solids were also reduced. (Baker-FRC)
W81-03139

TREATMENT IMPROVED THROUGH PROCESS CONTROL,
Durham City, NC. Div. of Water Resources.
A. T. Rolan, R. L. Barrow, and J. S. Welch.
Water/Engineering and Management, Vol 128, No 1, p 33-36, January, 1981.

Descriptors: *Biological treatment, *Process control, *Performance evaluation, *Waste water treatment, North Carolina, Nitrification, Biochemical oxygen demand, Activated sludge, Control systems, Check structures, Suspended solids, Durham.

The operation of an activated sludge plant can be improved when control tests such as those for wasting, return sludge rate and DO are used on a regular basis. This was demonstrated at the Northside Waste Water Treatment Plant of Durham, North Carolina, which was expanded in 1954 to handle a variety of domestic and industrial wastes. A description is given of the secondary treatment processes of the plant, which were adequate under the 1950's standards but are deficient under the current National Pollutant Discharge Elimination System. A plan was proposed to solve the problems of excessive infiltration and inflow. A second stage nitrification system was installed with final clarifiers designed to eliminate the biochemical oxygen demand and suspended solids problems. To optimize treatment performance, several operational control processes were implemented. Different methods of wasting activated sludge were tried, and a weir box was constructed to measure the volume of waste activated sludge. Only one of the three return sludge pumps was needed for return sludge, and sludge blanket depth was measured on a once-per-shift basis. Problems with the clarifiers were modified, and a centrifuge was pruchased for rapid determinations of solids in aeration tanks and return sludge. These and other renovations in process control have caused a dramatic improvement in plant performance. (Geiger-FRC)
W81-03142

WATER AND WASTE PROCESS ANALYTICAL PARAMETERS,
For primary bibliographic entry see Field 5A.
W81-03143

EXPERIMENTAL STUDY OF SUBMERGED BIOLOGICAL FILTRATION. (ETUDE EXPERIMENTALE DE LA FILTRATION BIOLOGIQUE IMMERGEE),
Montpellier-2 Univ. (France). Lab. de Genie Chimique, Traitement et Epuration des Eaux.
A. Grasmick, S. Elmaleh, and R. Ben Aim.
Water Research, Vol 14, No 6, p 613-626, June, 1980. 13 Fig, 10 Tab, 15 Ref.

Descriptors: *Model studies, *Wastewater treatment, *Biological filters, Food processing wastes, Biological treatment, Mathematical studies, Costs, Suspended solids, Bacteria.

The case of a submerged biological filtration unit treating an effluent with specific dissolved pollutants was examined to determine the fundamental parameters for a mass filtration apparatus for elimination of solids in suspension and to verify the authors' previously proposed model. Using reference tables established for different effluents, it was possible to simulate the behavior of this type of unit under various operating conditions, including filtration speed, pollutant concentration in the entering water, quality of the water to be purified and texture of the liner. The experiments were made on an effluent made of a powdered milk base (fat-free and with 5% by weight NH4NO3) and an effluent based on commercial food processing. Local oxygen concentrations, pollution concentrations and porosity were followed during each test. The solution of engineering equations based on the filtration model, which does not allow for recy-

cling, could not correspond to real construction conditions. The problem can be resolved by introducing objective functions (e.g., operation costs, investment costs, and an amortizing function) to optimize the solution and by considering the presence of important amounts of solid suspended particles, particularly bacteria. (Hertzoff-FRC)
W81-03147

CHEMICALLY AIDED SETTLEMENT OF CRUDE SEWAGE,
Department of the Environment, London (England)
J. L. Vosser.
Progress in Water Technology, Vol 12, No 5, p 411-426, 1980. 4 Fig, 8 Tab, 4 Ref.

Descriptors: *Chemical precipitation, *Coagulation, *Sedimentation rates, *Sewage treatment, Lime, Domestic wastes, Industrial wastes, Activated sludge, Hydrogen ion concentration, *United Kingdom.

Chemically aided settling of crude sewage and its effect on subsequent treatment are discussed. The chemical characteristics of sewage are first evaluated to determine which chemicals can be effective as coagulants. Following chemical addition, retention times in sedimentation tanks usually range from 1 to 2 hours for at least 75% removal. Phosphorus removal as measured by orthophosphate will be in the range of 50 to 95%, the highest removal occurring at pH levels of 10.5 or more. Lime or lime with ferric sulfate or alum may be used as a coagulant and precipitant. Use of chemically aided settlement makes possible a degree of peak load removal. When a crude mixed domestic and industrial sewage was dosed with lime even in a pH range as high as 11.0, the subsequent completely mixed activated sludge process was successfully operated without the need for pH correction. Sludges produced using lime were found to dewater well and may be suitable for land disposal. Sludges from alum and ferric salts are more difficult to dewater. Chemically added settling can yield at least 30% more sludge. (Small-FRC)
W81-03150

TOTAL ELIMINATION OF FLOATING SOLIDS IN OCEAN DISCHARGE OF TREATED EFFLUENT. (ELIMACION TOTAL DE SOLIDOS FLOTANTES EN EL VERTIDO AL MAR DE AGUAS RESIDUALES),
J. Fisac Herrero, and J. Rumeu Soldevilla.
Progress in Water Technology, Vol 12, No 1, p 393-402, 1980. 1 Fig.

Descriptors: *Screens, *Filtration, *Outfall sewers, Regulation, Oceans, Water pollution sources, Municipal wastes, Sewage disposal, *Spain.

Current Spanish legislation regulating the ocean disposal of waste water treated effluent is reviewed. Flotable material must be reduced to make effluent suitable for ocean disposal. A summary of methods is presented with emphasis on the use of curved fine screens. The design of such screens, their operation, and their performance are detailed. Results obtained using these screens are presented for several Spanish coastal areas. (Small-FRC)
W81-03151

ADVANCED MUNICIPAL WASTE WATER TREATMENT BY A SINGLE STAGE ACTIVATED SLUDGE SYSTEM,
Tahal Consulting Engineers, Ltd., Tel Aviv (Isreal).
G. Arueste.
Progress in Water Technology, Vol 12, No 5, p 533-550, 1980. 4 Fig, 3 Tab, 8 Ref.

Descriptors: *Activated sludge, *Nitrification, *Denitrification, Design, Performance, Biochemical oxygen demand, Phosphorus, Aerobic treatment, Treatment facilities, Municipal wastes, Israel, *Waste water treatment.

Two technical demonstration plants were operated to test a modified low-rate activated sludge process with nitrification-denitrification in a single stage, without primary settling, exogenous carbon sources, or chemical additions. The demonstration plants were operated under varying operating conditions prevailing in the Dan Region (Tel Aviv, Israel) in order to establish planning criteria for design of the full-scale treatment plant. The proposed system demonstrated efficiency and reliability for a full range of local conditions. Effective BOD removal was 98%, and COD removal was 90%. Total nitrogen removal ranged from 86.5 to 95.5%, and total phosphorus removal ranged from 63% to 95%. When aerobic and anoxic conditions were alternated in the aerobic reactor, the higher nitrogen removal rates were obtained. The addition of a short retention anaerobic basin preceding the denitrification zone enhanced the phosphorus removal to the highest level. When built, the treatment facility will include a waste water renovation plant based on a modified low-rate activated sludge process with a design capacity of 116 MCM/year. (Small-FRC)
W81-03155

PHYSICAL AND CHEMICAL METHODS,
Florida Univ., Gainesville.
J. Zoltek, Jr., and E. L. Melear.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1143-1156, June, 1980. 155 Ref.

Descriptors: *Waste water treatment, *Literature review, Advanced waste water treatment, Coagulation, Chemical coagulation, Separation techniques, Mathematical studies, Model studies, Ion exchange, Adsorption, Membrane processes, Oxidation, Oxidation process.

A literature review on physical and chemical methods of waste water treatment is presented. Some general topics discussed include advanced waste water treatment technologies, centralized treatment of industrial wastes, the hydraulic characterization of waste water treatment basins, reclamation of secondary effluents, the handling of great flow variations, granular activated carbon systems, the additions of alum to aeration units, the use of potassium ferrate as a coagulant and disinfectant, and ammonium removal. Over 50 studies dealing with coagulation and the separation of solids are cited, many of which are laboratory-scale, model or mathematical studies. References to over 35 studies on some chemical or physical aspect of adsorption are considered, and research on the use of ion exchange techniques in waste water treatment is reviewed. Experiments dealing with membrane and oxidative processes are also cited. (Geiger-FRC)
W81-03164

BIOLOGICAL FILTERS,
Colorado State Univ. at Boulder.
G. L. Rogers, and S. L. Klemetson.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1156-1161, June, 1980. 46 Ref.

Descriptors: *Biological filters, *Literature review, *Waste water treatment, Pilot plants, Trickling filters, Industrial wastes, Chemical oxygen demand, Microbial studies, Mathematical studies, Waste recovery, Denitrification, Model studies.

A literature review of biological filters for waste water treatment is presented. Nineteen works dealing with rotating biological contactors (RBC's) are cited. These studies cover such topics as design problems, saline waste water treatment, available models, advanced waste water treatment, chronological development of RBC's, denitrification, the treatment of industrial wastes, chemical oxygen demand removal, and oxygen mass transfer. Literature dealing with trickling filters covers such topics as reaction rate coefficients, pilot plants, Monod kinetics, aerobic biological treatment, eutrophication problems, design of plastic media filters, and problems in filter performance. Miscellaneous research cited includes work on the use of waste water as an energy source, phosphorus removal, mathematical studies, packed bed reactors, waste recovery, pilot plants, and the microbial kinetics of waste water treatment. (Geiger-FRC)
W81-03165

LAGOONS AND OXIDATION PONDS,
Utah State Univ., Logan. Div. of Environmental Engineering.
D. B. George.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1177-1181, June, 1980. 37 Ref.

Descriptors: *Literature review, *Aerated lagoons, Aeration, Waste water treatment, Bibliographies, Performance evaluation, Sand filters, Model studies, Mathmatical models, Odor control, Coliforms, Algal control, *Lagoons, *Oxidation ponds.

A literature review is presented of works concerned with lagoons and oxidation ponds used in the treatment of waste waters. Two annotated bibliographies on aeration lagoons have been published by the National Technical Information Service, and another study outlined the removal of solids from lagoon effluents. Papers dealing with research on the process design of aeration lagoons are cited, and references to works on process performance and aeration lagoon biology are given. Numerous references to lagoon improvement studies are considered and include such topics as sand filtration, algae removal, the effects of vascular plants, hydraulic advances, and oxygen transfer. Experiments using biogeochemical models, and the use of mathematical models to predict fecal coliform decay rates and odor production are also cited. (Geiger-FRC)
W81-03166

DENITRIFICATION,
Metropolitan Sanitary District of Greater Chicago, IL.
T. B. S. Prakasam, and M. Krup.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1195-1205, June, 1980. 88 Ref.

Descriptors: *Literature review, *Denitrification, Nitrification, Bibliographies, Waste water treatment, Fluidized bed process, Kinetics, Pilot plants, Biological treatment, Sand filters, Nitrogen removal.

A literature review of denitrification in waste water treatment is presented. Topics covered under slurry processes include microbial stoichiometry, full scale and pilot plants, sequencing batch biological reactors, nutrient removal, treatment of limed primary effluents, handling of various waste waters, and suspended-growth denitrification process performance evaluations. References dealing with attached growth processes cover such topics as fluidized bed bioreactors, the Denite filter system, bench- and pilot-scale studies, anaerobic and sand filter processes, rotating biological contactors and the nitrification and denitrification of night soil. Various studies are cited which examine some aspect of soil denitrification, process microbiology or process kinetics. References to books, reviews, and patents concerned with denitrification processes in waste water treatment are also given. (Geiger-FRC)
W81-03168

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
P. A. Vesilind,.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1205-1214, June, 1980. 163 Ref.

Descriptors: *Literature review, *Sludge disposal, *Waste water treatment, Sludge thickening, Sludge drying, Sludge utilization, Sludge conditioning, Landfills, Land reclamation, Land disposal, Waste disposal, Leaching, Heavy metals, Public health, Model studies.

A literature review is presented of the treatment, utilization, and disposal of sludge from waste water treatment processes. The EPA process design manual for sludge treatment and disposal has been updated and other extensive works on sludge management, treatment and disposal have been pub-

lished. References are given for studies dealing with sludge properties, planning and management, and industrial, nutrient-laden, and water treatment sludges. Works on thermal conditioning and incineration, thickening, dewatering, and sludge stabilization are cited. Topics covered under studies on the ultimate disposal of sludge include land disposal, reclamation of abandoned mine sites, health hazards, the agricultural value of sludge, leaching and leaching models, trenching, effects of sludge application on soil properties, heavy metal translocation, and the use of sludge as supplementary animal feed. References to the ocean dumping of sludge are given, and reviews of the sludge disposal problems of New York City are cited. (Geiger-FRC)
W81-03169

ON-SITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
W. C. Boyle, and R. J. Otis.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1214-1220, June, 1980. 54 Ref.

Descriptors: *Reviews, *Septic tanks, *Soil disposal fields, Sewage disposal, Underground waste disposal, Sewerage, Rural areas, *Waste water treatment, *Waste water disposal, Sanitary engineering, Water reuse, Path of pollutants, Foreign countries.

The 1979 papers published on on-site waste water treatment and disposal are reviewed. General reports, some from conference proceedings on disposal for rural areas and small communities, have been published by National Utility Contractors, National Environmental Health Association, the Environmental Protection Agency, and other groups. Subjects included in the review are toilet systems reusing gray water, subsurface disposal systems (pollutant migration in the soil, performance of soil absorption systems), and sanitation in developing countries, where on-site disposal is more technically, economically, and culturally suitable than conventional sewerage using enormous quantities of water. Evaluation of alternatives and management methods are described. (Cassar-FRC)
W81-03170

OPERATION AND MAINTENANCE OF WASTE WATER COLLECTION AND TREATMENT FACILITIES,
Montgomery (James M.), Pasadena, CA.
D. D. Drury.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1220-1223, June, 1980. 32 Ref.

Descriptors: *Reviews, *Waste water treatment, *Operation and maintenance, Insecticides, Disinfection, Activated sludge, Monitoring, Waste disposal, Water treatment facilities.

Recent papers on waste water collection and treatment facilities operation and maintenance are summarized in a review. A manual written for managers of small treatment facilities has been published by the Environmental Protection Agency. Recent studies and developments in operating the activated sludge process are described. Problems in solids handling, disinfection with ultraviolet light and chlorination, performance indicators for collection systems, use of insecticides in waste water treatment, and self-monitoring programs are among other topics covered. (Cassar-FRC)
W81-03171

WASTEWATER COLLECTION,
Sewer System Evaluations, Inc., Chicago, IL.
S. Chatterjee, and J. Wilcox.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1232-1241, June, 1980. 103 Ref.

Descriptors: *Reviews, *Waste water collection, *Design criteria, Pipes, Evaluation, *Waste water treatment, Rehabilitation, Regulations, Sewage treatment, Sewers, Manholes, Infiltration, Combined sewers, Construction, Planning, Management.

Information on waste water collection was presented in several reviews published during 1979 as well as in many individual papers reviewed in this article. Subjects discussed are new regulations, planning and management information, plans for two major cities' collection projects (Montreal and Chicago), design considerations, construction problems and solutions, techniques and hazards of sewer maintenance, sewer system evaluation, correction of infiltration/inflow problems, rehabilitation of deteriorated sewer systems, overflow control in combined sewers, and waste water pumping. (Cassar-FRC)
W81-03173

WATER RECLAMATION AND REUSE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
D. W. Smith.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1242-1284, June, 1980. 443 Ref.

Descriptors: *Reviews, *Water reuse, *Agriculture, Irrigation, Planning, *Waste water treatment, Aquaculture, Effluents, Chemical industry, *Industrial wastes, Textiles, Pulp and paper wastes, Water supply, Groundwater recharge, Drainage, Cooling water, Model studies, Food processing industry.

A review of recent (1978-1979) literature on water reclamation and use highlights the Water Reuse Symposium held March 25-30, 1979, in Washington, D.C., which dealt with water reuse from the research, development, and application viewpoints. In addition to a summary of general papers, the article discusses recent developments in water resources planning (models, options in waste water reuse); agriculture and irrigation with waste water from municipal treatment plants and drainage from fields; aquaculture of water hyacinth, algae, and fish in effluent from municipal waste water and powerplant cooling water; reuse of animal wastes as feed; and groundwater recharge. Topics on industrial waste water reuse and recovery are divided into general, pulp and paper, food, metals, textiles, petroleum and chemicals, and power plants. Efforts to reclaim municipal water for use as a water supply are discussed. Papers on health considerations of water reuse mention chemical pollutants, pathogens, and mutagens. (Cassar-FRC)
W81-03174

LAND APPLICATION OF WASTE WATER,
Nielson, Maxwell and Wangsgard, Salt Lake City, UT.
J. H. Reynolds, and J. A. Cissell.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1284-1290, June, 1980. 1 Tab, 55 Ref.

Descriptors: *Water reuse, *Land disposal, Irrigation, Waste water renovation, Waste water disposal, Waste water irrigation, Irrigation programs, Irrigation practices, Literature review.

Various research studies dealing with the application of waste water to the land are cited for brief review. Design parameters were investigated in a winter spray irrigation study and in a study applying raw and secondary treated waste water to overland areas in Oklahoma. Specific case studies were reported from South Tahoe Public Utility District; Toulumne County, California disposal system; Tallahassee, Florida; Michigan State University Water Quality Management Facility; West Dover, Vermont; Puerto Rico; and Oahu, Hawaii. Long-term effects of land applications were studied on the high plains of west Texas. Effects on groundwater nitrate concentrations and microbial penetration were also investigated. The impact of such practices on the quality of surface waters was investigated in Muskegon County, Michigan. Movement and adsorption characteristics of a virus in a soil column of loamy sand were assessed using waste water seeded with poliovirus. Several forest ecosystems irrigated with treated municipal waste water were examined. Proceedings of a 5-day symposium on water reuse contained several papers dealing with land application. (Baker-FRC)
W81-03175

INSTRUMENTATION AND AUTOMATION OF WASTE WATER COLLECTION AND TREATMENT SYSTEMS,
Environmental Research Lab., Cincinnati, OH. Office of Research and Development.
M. D. Cummins, A. C. Petrasek, Jr., W. W. Schuk, J. F. Roesler, and D. S. Brown.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1307-1312, June, 1980. 60 Ref.

Descriptors: *Literature review, *Waste water treatment, *Waste water collection, Automation, Computers, Management planning, Control systems.

Various advances made in the field of instrumentation for the collection and treatment of waste water are cited in this review. Specific literature reviews are cited first, dealing with equipment for use in waste water treatment plants, automation of waste water treatment, process control systems, waste water characteristics, economic incentives, equipment failures, sensing devices, and software considerations. Many papers appeared during 1979 dealing with the capability of automation and instrumentation to solve real problems facing the waste water treatment industry. The various uses of computers in monitoring systems were investigated. Papers also appeared concerning pH control concepts, a closed-loop analog control system for breakpoint chlorination, operator interfacing, and application of instrumentation techniques for water distribution systems. Various control strategies were reviewed relevant to the waste water treatment field, which may accelerate the implementation of more sophisticated control technology. The development of on-line analyzers and the design, specifications, and purchase of distributed process control systems were reviewed. (Baker-FRC)
W81-03177

HEALTH EFFECTS ASSOCIATED WITH WASTE WATER TREATMENT AND DISPOSAL,
Environmental Protection Agency, Cincinnati, OH.
N. E. Kowal, and H. R. Pahren.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1312-1325, June, 1980. 125 Ref.

Descriptors: *Literature review, *Waste water treatment, *Waste water disposal, Viruses, Bacteria, Bacteriophage, Land application, Composting, Diseases, *Public health, Sludge disposal, Organic compounds, Inorganic compounds.

Recent research conducted in the area of health effects resulting from waste water treatment and disposal is reviewed. Studies dealing with waste water treatment plants have centered around viral hepatitis epidemiology, unexplained fever, eye irritation, headache, throat irritation, proteinuria, and elevated serum lactic dehydrogenase. An extensive study of health effects of aerosols emitted from an activated sludge plant is cited. Also cited is a workshop report on health and legal implications of waste water sludge composting, a history of land treatment of waste water including land application historical perspectives, a discussion of the federal groundwater protection program, and reports of parasites, bacteria, and viruses arising from land application of waste water. The uptake of various organics from sludge applications into crops was investigated, and similar research was conducted regarding inorganic chemical uptake into food crops. The proportion of waste water seeping into the drinking water supplies in the US was investigated, with studies arising concerned with parasites, bacteria, viruses, organics, and inorganic contaminants entering the water supply from this source. (Baker-FRC)
W81-03178

MEAT, FISH, AND POULTRY PROCESSING WASTES,
Battelle Columbus Lab., OH.
J. H. Litchfield.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1325-1329, June, 1980. 1 Tab, 43 Ref.

Descriptors: *Industrial wastes, *Waste water treatment, Waste water management, *Meat processing industry, Industrial plants, Fish, Poultry, Filters, Flotation, Salmon, Shrimp, Industrial waste water, *Literature review.

Recent research conducted on processing wastes from the meat, fish, and poultry industries is cited. Effluent limitations on conventional pollutants, reviews on slaughterhouse waste water treatment methods, processes for protein recovery from waste water and waste water treatment sludges, plant and pilot-plant studies, the use of activated sludge treatment for slaughterhouse wastes, use of extended aeration-intermittent sand filtration for treating wastes from small packinghouses, treatment of processing wastes containing blood, use of lignosulfonate for slaughterhouse waste water treatment, electroflotation, and ultrafiltration methods are all reviewed. In the area of fish processing, specific laws pertaining to the treatment of tuna, salmon, shrimp and oyster processing waste waters are reviewed. Reviews dealing with the waste segregation, water conservation, waste water treatment, and regulatory aspects of poultry processing wastes are also cited. (Baker-FRC)
W81-03179

FRUIT, VEGETABLE, AND GRAIN PROCESSING WASTES,
Kramer, Chin and Mayo, Inc., Seattle, WA.
R. M. Andrews, and M. R. Soderquist.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1329-1333, June, 1980. 30 Ref.

Descriptors: *Industrial wastes, *Literature review, Fruit crops, Vegetable crops, Grain crops, *Waste water treatment, Water conservation, Economic aspects.

Recent research in the area of controlling processing wastes from the fruit, vegetable, and grain industries is cited. The EPA recently withdrew its effluent limitations guidelines for best available control technology economically achievable and new source performance standards for canned and preserved fruits, vegetables and miscellaneous specialties. In the future new standards will be released. Specific investigations included research on the feasibility of recovering pulp from caustic peeled tomato skin, a comparison between the filter press, belt press and centrifuge as means of dewatering citrus processing activated sludge, the economics of reclaiming activated sludge effluent at a fruit cannery, a prototype system for washing leafy vegetables, aerobic fermentation of pickle process brine, and studies of the characterization of waste water from specific industrial operations to assess its amenability to treatment. (Baker-FRC)
W81-03180

FERMENTATION INDUSTRY,
Notre Dame Univ., IN. Dept. of Civil Engineering.
R. L. Irvine.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1333-1340, June, 1980. 87 Ref.

Descriptors: *Literature review, *Fermentation, *Food-processing wastes, *Waste water treatment, Water quality, Water pollution control, Byproducts, Distilleries, Pharmaceuticals.

Articles published in 1979 on water pollution control in the fermentation industry are briefly reviewed. Of the 87 articles covered, 5 were reviews: one of Japanese literature, one on distillation for the recovery of ethanol from brewery effluent, and three on the pharmaceutical industry. The majority of the articles dealt with the reuse, recycling, and recovery of by-products previously discarded as wastes. Nine articles considered the production of single cell protein from a variety of fermentation wastes. The production of food substitutes and fertilizers was examined in other articles. Treatment alternatives were the subject of other articles on breweries and yeast manufacture, distilleries, wineries, and pharmaceuticals. (Small-FRC)
W81-03181

DARIY WASTES,
Kraft, Inc., Glenview, IL.
J. C. Groenewold.
Journal of the Water Pollution Control Association (Literature Review Issue), Vol 52, No 6, p 1340-1342, June, 1980. 29 Ref.

Descriptors: *Literature review, *Dairy industry, Food-processing wastes, Environmental effects, Water quality, Water pollution control, *Waste water treatment.

A literature review on the environmental effects of dairy wastes is presented which includes articles published during 1979. Articles on legislation, regulation, and economics covered such topics as the effects of current European environmental laws on dairies, water recovery systems, and the effects of EPA discharge regulations on the industry. Recent research in the area includes a study of the addition of specifically selected bacterial cultures to a dairy waste treatment system and advances in by-product recovery. Several papers dealt with case histories. Treatment of dairy waste water in a recirculating oxidation canal was evaluated, as was joint treatment of dairy and municipal waste water. Several general articles considered the impact of dairy wastes on groundwater quality. (Small-FRC)
W81-03182

AGRICULTURAL WASTES,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
J. W. Morris, and W. W. Clarkson.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1342-1383, June, 1980. 4 Tab, 441 Ref.

Descriptors: *Literature review, *Agricultural wastes, *Farm wastes, Water quality, Water pollution control, *Waste water treatment.

A literature review is presented on the impact of agriucltural wastes on water quality. Articles published during 1979 on the following topics are included: waste characteristics and impacts, handling and treatment, utilization of wastes such as in production of methane, land application, legal aspects including new regulations, and economic aspects. Agricultural wastes recovered as useful products are outlined, and some comments are made on the waste characteristics. For example, shellfish wastes are useful as sludge dewatering agents. Reclaimed agricultural wastes are often used in refeeding experiments. These wastes include whey, cereal straw, rabbit manure, and others. The influence of waste water sludge applications on agricultural crops was the subject of many studies. Effects on corn, wheat, barley, forest, garden vegetables, and earth worms were investigated. Five bibliographies were produced relating energy production and agricultural wastes. (Small-FRC)
W81-03183

TEXTILE WASTES,
Auburn Univ., AL. Dept. of Civil Engineering.
J. F. Judkins, Jr.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1383-1385, June, 1980. 26 Ref.

Descriptors: *Literature review, *Textile mill wastes, Water quality, Water pollution control, *Waste water treatment.

A literature review is presented of articles published during 1979 dealing with the effects of textile wastes on water quality. The impacts of the Toxic Substances Control Act, the Resources Recovery and Conservation Act, and Swiss regulations on the textile and fiber industry were considered in several papers. The topic of treatment was the subject of the majority of articles printed. A literature review was published on the removal of color from textile effluents: one paper dealt with the effects of heavy metals in wastes; and others considered the recycling of dyehouse effluent. New treatment processes were described, including one paper on ultrafiltration for treating wool scouring liquors. A horizontal discharge, surface aerator was evaluated. One article on tannery wastes evaluated the use of hydrogen peroxide as an effective method for oxidizing sulfides. (Small-FRC)
W81-03184

PULP AND PAPER INDUSTRY WASTE WATER MANAGEMENT,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
G. W. Gove.
Journal of the Water Pollution Control Association (Literature Review Issue), Vol 52, No 6, p 1386-1415, June, 1980. 187 Ref.

Descriptors: *Pulp and paper industry, *Waste water management, *Literature review, Combined treatment, Water quality management, Water pollution control.

A literature review is presented of articles published during 1979 on waste water management in the pulp and paper industry. Articles dealt with joint or combined treatment, forestry practices, water quality management, and economics. Many papers described effluent sources and treatment methods, including internal measures. Receiving waters, biological effects, and effluent characterization were the topics of other works. Physicochemical treatment including waste water renovation, reuse, and solids and heat recovery was discussed in papers on kraft mills, bleached-kraft, and sulfite pulping. Secondary treatment including activated sludge, biooxidation, and foam control was the subject of several studies. (Small-FRC)
W81-03185

MICROBIOLOGY OF WASTE WATER TREATMENT,
Drexel Univ., Philadelphia, PA.
W. O. Pipes.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1847-1853, June, 1980. 68 Ref.

Descriptors: *Waste water treatment, *Microbiological studies, *Reviews, Microbial degradation, Microorganisms, Disinfection, Denitrification, Nitrogen removal, Nitrification, Sludge.

Recent literature reports of work in the field of waste water treatment, with emphasis on the microbiological aspects, are reviewed. A number of investigators continue to be interested in disinfection, nitrification and dentrification, and potential health hazards from land disposal of effluents. Disinfection was studied in some systems using coagulation plus sand filtration, direct filtration, and carbon adsorption as tertiary waste water treatment. The systematics, morphology and ecology of flagellated protozoa in waste water treatment plants were investigated in studies on trickling filters. The use of activated sludge and oxidation ponds was considered. Several studies were conducted on the pathogenic organisms that might be present in waste water sludges so that estimates could be made of the potential risk of disease transmission through land application of the sludge. (Baker-FRC)
W81-03188

LAND TREATMENT USES SLUDGE AT MADISON, WISCONSIN,
Madison Metropolitan Sanitary District, WI.
J. Cunningham, J. L. Nemke, and D. Marske.
Water and Sewage Works, Vol 127, No 3, p 28-29, 49, March, 1980. 2 Fig, 2 Ref.

Descriptors: *Sludge, *Land disposal, Sludge disposal, *Waste disposal, *Recycling, Fertilizers,

Fertilization, Farming, Agriculture, Erosion control, Municipal wastes, Domestic wastes, Solid wastes, Aerobic digestion, Water reuse.

Land application of sludge in Madison, Wisconsin has been shown effective. The system won active farmer cooperation, stimulated crop growth, protected the environment, and sharply reduced disposal costs. Variables that were considered before starting the system included soil composition, depth of water table, runoff to nearby waterways, depth of bedrock, flood-plain location, crop selection and weather conditions prevalent in the area. Sludge conditioning yields a product called Metrogro, which is offered to farmers as a processed organic fertilizer. Solid waste is converted by an anaerobic digestion process into two valuable products, methane gas and a liquid sludge. The gas meets the plant's internal energy needs, and the liquid is a rich, organic fertilizer and soil conditioner. (Baker-FRC)
W81-03189

GUIDE TO COMPARATIVE TREATMENT MODE EFFICIENCIES,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
S. K. Banerji, and J. T. O'Conner.
Water and Sewage Works, Vol 127, No 8, p 32, 33, 54, 56, August, 1980. 2 Fig, 5 Tab, 7 Ref.

Descriptors: *Water treatment facilities, *Waste water treatment, *Cost analysis, Cost savings, Economic aspects, Energy, Management planning, Planning.

A conventional 10-MGD domestic secondary waste water treatment plant requires the primary energy consumption for several preliminary and primary treatment processes for domestic sewage. Raw-sewage pumping takes by far the largest share. Use of variable-speed pumps can reduce the pumping energy consumption by as much as 15-20%. Use of square grit chambers with aeration can also reduce energy consumption. A flow-equalization basin at the head end of the plant can dampen the diurnal flow variation to the treatment units. In the area of disinfection, ozone disinfection systems using oxygen ozone generation are energy effective if secondary energy requirements for chlorine are included. The choice for sludge digestion per pound of volatile solids stabilized, it has been suggested that heat treatments be applied to waste-activated sludge prior to primary sludge addition followed by anaerobic digestion of the mixture. Many designers are putting together energy recovery systems by supplying conditioned and filter-pressed raw sludge to an incinerator or a pyrolysis unit. Raw sludge need not be stabilized by digestion. It can be dewatered to 30-40% solids concentration prior to incineration or pyrolysis. The process is said to be cost-and-energy effective for areas having populations larger than 200,000. (Baker-FRC)
W81-03190

TREATMENT OF URBAN OR INDUSTRIAL EFFLUENTS BY ENTRAINMENT OF POLLUTANTS WITH THE PRECIPITATION OF CACO3. (TRAITEMENT DES EFFLUENTS URBAINS OU INDUSTRIELS PAR ENTRAINEMENT DES POLLUANTS A L'OCCASION D'UNE PRECIPITATION DE CACO3),
Institut National des Sciences Appliquees, Toulouse (France). Lab. de Chimie et Genie de l' Environnement.
A. Esparaza, A. Girou, H. Roques, and A. Durand.
Water Research, Vol 14, No 10, p 1459-1466, October, 1980. 9 Fig, 1 Tab, 6 Ref.

Descriptors: *Lime, *Flocculation, *Waste water treatment, Adsorption, Calcium carbonate, Separation techniques, Oxygen demand, Suspended solids, Municipal waste water, Toulouse, France.

Initial tests of the CaCO3 precipitation induced by the reaction of lime with a current of CO2 enriched gas bubbled through the solution were followed by tests on a 30 l/hr laboratory pilot unit. The unit consists of a crystallization reactor with a nucleation chamber base. Tests were made on Toulouse urban effluent with suspended matter contents of 200-250 mg/liter, COD of 350-600 mg/liter, total TOD of 450-700 mg/liter, soluble TOD of 200-250 mg/liter, pH of 7-7.5, 30-100 mg/liter phosphates, 0.8-1.5 mg/liter Zn(++), 0.5-1 mg/liter Cu(++) and about 0.04 mg/liter Cr(++). A break appearing on the curves of the total TOD and the COD as a function of the amount of added lime is interpreted as pollution elimination by flocculation at low lime content, followed by an elimination of soluble pollutants by adsorption at lime concentrations >0.5 g/liter. This was confirmed by microscopic examination of the precipitate. The yields of total TOD and COD were 80% at lime doses of about 4-5 g/liter. Suspended substances, phosphates and heavy metals were practically eliminated with lime doses of 2.35 g/liter, 2 g/liter and 4-5 g/liter, respectively. Since the pH attained and Ca(+) concentrations are very high, pathogens are largely deactivated. Recycling of the sludges into the crystallizer was beneficial, since the concentrations of organic substances in the effluent is too high. Six stations of this type have been built and three more are planned. (Hertzoff-FRC)
W81-03215

EVALUATION OF LIPIDS AND THEIR ELIMINATION IN DIFFERENT TYPES OF SMALL CAPACITY PURIFICATION STATIONS. (INVENTAIRE DES LIPIDES ET LEUR ELIMINATION AU NIVEAU DE DIFFERENTS TYPES DE STATIONS D'EPURATION DE PETITE CAPACITE),
Institut Pasteur de Lyon (France). Lab. de Toxicologie et d'Hygiene Industrielle.
M. Pierson, P. Chambon, and J. Vial.
Water Research, Vol 14, No 9, p 1313-1316, September, 1980. 2 Fig, 2 Tab, 9 Ref.

Descriptors: *Waste water treatment, *Lipids, Waste water facilities, *France, Nutrient removal, Rhone river, Biological treatment.

Twenty-four-hour samples taken at the entrance and exit of four types of waste water treatment facilities were analyzed for BOD, COD, surfactants, and free and esterified fatty acids. The purpose of these tests was to estimate the elimination of lipids by different types of purification stations, to evaluate the lipids at the entrances and exits, and to determine the theoretical incidence of the lipid fraction in the measurement of COD. Oleic, palmitic and stearic acids were the most frequently found in the influent and effluent. A good elimination (between 80 and 99%) was observed for these compounds. The tests were made at the Rhone stations of Messimy (operating on activated sludge with a productivity of 240 m super 3/d) during a dry September after 3 hr, Thurins (bacterial bed on coke with productivity of 200 m super 3/d) during a dry July after 14 hr, Arnas (bacterial bed on discs with productivity of 100 m super 3/d) during a dry July after 8 hr, and St. Didier sur Beaujeu (bacterial bed on Cloisonyle tubes with productivity of 75 m super 3/d) during a rainy October after 7 hr. This study did not indicate that any one type of purification station would outperform another in eliminating the lipids entering the station. (Hertzoff-FRC)
W81-03216

ANALYSIS AND DESIGN OF EQUALIZATION BASINS BY CONTINUOUS SIMULATION. (ANALYSE ET DIMENSIONNEMENT DES BASSINS D'EQUILIBRE PER SIMULATION CONTINUE),
Ecole Polytechnique, Montreal (Quebec). Dept. of Civil Engineering.
G. G. Patry.
Canadian Journal of Civil Engineering, Vol 7, No 4, p 621-628, December, 1980. 8 Fig, 6 Tab, 11 Ref.

Descriptors: *Computer models, *Equalization reservoirs, *Waste storage, Simulation analysis, *Waste water treatment, Domestic wastes, Engineering, Design criteria.

Design of domestic waste water equalization basins is aided by a method based on the continuous simulation of the process using CSMP/360 (continuous system modeling program) simulation language. The model EQUIL can simulate different operating conditions and construct response curves from which the optimum volume of the basin may be determined for specified effluent variations. (Cassar-FRC)
W81-03225

ALBANY COUNTY SEWER DISTRICT, NEW YORK,
Albany County Sewer District, NY.
C. D. DeFazio.
Journal of the Water Pollution Control Federation, Vol 52, No 3, p 642-644, March, 1980. 4 Tab.

Descriptors: *Water treatment facilities, *Municipal wastes, *Activated sludge, Industrial wastes, Domestic wastes, Sedimentation, Chlorination, *Waste water treatment, Sludge thickening, *New York, Albany County.

The Albany County Sewer District (New York) has two plants: the North Plant with a design capacity of 1.5 cu m/s (35 mgd) and the South Plant with a design capacity of 9.8 cu m/s (19 mgd). The plants handle domestic waste water and industrial waste water, although some of the industrial waste is pretreated. Both plants include preliminary treatment, primary settling, activated sludge secondary treatment, and final settling followed by chlorination. Effluent concentrations are below permit levels. Removals of BOD and suspended solids average 95.7 and 93.5% at the North Plant and 92.9 and 91.7% at the South Plant. Total Kjeldahl nitrogen levels average 4.0 mg/liter at the North Plant and 2.4 mg/liter at the South Plant. At both plants, flotation thickeners thicken waste activated sludge to 4 to 5% solids. Sludge is dewatered using vacuum filters and chemical conditioning to 20 to 30% solids and then incinerated. At the North Plant, it cost $505,856.00 to treat and incinerate 8,141 dry tons of sludge, while at the South Plant it cost $311,161.00 to treat and incinerate 3,428 dry tons. Operating costs for 1978 were $.189 per 1000 gal treated for the North Plant and $.116 for the South Plant. (Small-FRC)
W81-03239

ION EXCHANGE IN THE RECYCLING OF PLATING EFFLUENTS,
Marie Curie-Sklodowska Univ., Lublin (Poland).
L. Pawlowski, and R. Zalewski.
Effluent and Water Treatment Journal, Vol 20, No 12, p 581, 583-585, December, 1980. 6 Fig, 2 Tab.

Descriptors: *Chromium compounds, *Plating industry, *Ion exchange, *Recycling, Metals, *Waste water treatment, Chromates, Separation techniques, Anion exchange, Cation exchange, Pollution abatement, Effluents, Industrial wastes.

Chromates in plating bath waste water were cation-exchanged in a strong acid fixed bed, then passed through a weakly basic anion exchanger (Amberlite IRA67) to absorb the chromates. Deionized water was recycled to the rinsing tank. Optimum regeneration of ion exchange beds was determined. The anion exchange bed was treated with 105.5 g per cu dm and operated at a flow rate of 2.73 m per hour. Ion exchange capacity was 73.2 g Cr(6+) per cu dm. Recirculation of 23% of the absorbed chromates in head and tail fractions into the raw waste water allowed significant increases in average concentration of regenerated effluent (from 25 g to 47 g Cr(6+)). This solution was used for refilling the plating bath. (Cassar-FRC)
W81-03240

GAS-LIQUID DISSOLUTION IN WASTE WATER TREATMENT,
Cahn, Inc., Wallingford, CT.
M. A. Vivona.
Public Works, Vol 111, No 3, p 73-76, March, 1980. 5 Fig, 6 Ref.

Descriptors: *Waste water treatment, *Activated sludge, *Dissolved oxygen, Aeration, Gases, Energy, Mixing, Efficiencies, Design criteria.

Comparisons of alternative gas-liquid dissolution techniques concern three performance characteristics--energy requirements, efficiency, and mixing. Performances of the two-stage process and the submerged gas diffuser in waste water treatment were compared. The efficiency at 5 ft depth and a 1.15 feed ratio in the aeration of an equalization basin was 44% for the two-stage process. The submerged diffuser, which requires extremely high gas feed rates to produce proper mixing, had an efficiency of 2.5%. Increasing the submergence depth increased efficiency; higher feed rates lowered it. Energy costs for the sample described in the paper, a 37,500 gal per day activated sludge aeration process, were 0.97 kw for the two-stage process and 2.25 kw for the submerged diffuser. (Cassar-FRC)
W81-03247

PRINCIPLES OF DYE REMOVAL FROM TEXTILE EFFLUENT,
Queen's Univ., Belfast (Northern Ireland). Dept. of Industrial Chemistry.
G. McKay, and A. G. Sweeney.
Water, Air, and Soil Pollution, Vol 14, No 1, p 3-11, 1980. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Textiles, *Dyes, *Activated carbon, Adsorption, Industrial wastes, *Waste water treatment, Dye industry wastes, Dye removal.

Removal of Disperse Blue 7 Dye from a textile effluent with activated carbon was studied. At low dye concentrations the equilibrium adsorption data conformed to the Langmuir isotherm for a carbon particle size of 500-710 micrometers. Increasing agitation increased the rate of color removal, as did increases in temperature. Initial dye concentrations of 50, 100, 200, and 300 mg per liter formed a linear relationship when the log surface mass transfer coefficient and log initial concentration were plotted on a graph. As the particle size of carbon decreased, the rate of dye removal increased. (Cassar-FRC)
W81-03249

5E. Ultimate Disposal Of Wastes

ECONOMIC ANALYSIS OF RURAL SLUDGE MANAGEMENT,
University of Central Florida, Orlando. Dept. of Economics.
R. G. Fritz.
Compost Science, Vol 21, No 3, p 22-26, May/June 1980. 6 Tab, 27 Ref. OWRT-A-031-VT(2), 14-34-0001-7096.

Descriptors: *Sludge disposal, *Regional economics, *Rural areas, Cost comparisons, Cost analysis, Soil amendments, Landfills, Sludge utilization, Sludge spreading, *Rural sludge management costs.

The costs of sludge disposal, or the final stage of waste water management for rural communities in Vermont were analyzed. Distance to disposal sites, population increases and potential agricultural use were considered in comparing the costs of landfill and landspreading as disposal alternatives. Although a decline in the average cost of sludge management has commonly been found to accompany population increase, this study indicates that such economies of scale are valid only for relatively large treatment facilities. For the small rural communities studied, diseconomies of scale prevail, per capita costs increasing with population. There was no significant evidence that either of the two methods of sludge management, landfill or landspreading, was less expensive than the other. However, per capita disposal costs associated with the use of flotation thickeners and vacuum filters were significantly higher than those associated with liquid and sand drying bed dewatered sludge. Total costs of liquid sludge disposal were much more responsive to changes in distances to disposal sites than were costs associated with dewatered sludge disposal. The nutrient value of sludge when used as a fertilizer supplement was $34.88 per tonne in 1976. The sale of sludge has potential for cost recovery. An average of 95% of the costs of sludge management would be recovered if the sludge could have been sold at the maximum potential nutrient value as fertilizer.
W81-02933

WATER-LEVEL DATA FOR WELLS IN BURIAL GROUND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1975-1979,
Geological Survey, Knoxville, TN. Water Resources Div.
D. A. Webster, J. S. Beatty, P. M. Benjamin, and W. M. Tranum.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $11.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 81-57, August, 1980. 100 p, 2 Tab, 1 Ref, 1 Plate.

Descriptors: *Water levels, *Water wells, Data collections, *Tennessee, Water measurement, Well data, Hydrographs, Water level fluctuations, *Radioactive waste disposal, *Solid waste disposal, Sites, *Oak Ridge National Laboratory, Burial ground.

At Oak Ridge National Laboratory, Tenn., solid waste materials contaminated by low levels of radioactivity are disposed of in shallow trench burial areas termed 'burial grounds'. Data pertaining to wells in Burial Ground 6 are presented for the period 1975 to 1979. Included are an inventory of wells, measurements of water levels, well hydrographs, and a map showing the location of the wells. (USGS)
W81-02989

TORONTO TURNS SLUDGE INTO ENERGY,
Gore and Storrie, Ltd., Toronto (Ontario).
P. DaSilva.
Water and Wastes Engineering, Vol 17, No 8, p 16-18, August, 1980. 2 Tab.

Descriptors: *Sludge treatment, *Incineration, *Sludge disposal, Ultimate disposal, Waste water treatment, Soil amendments, Disposal, *Toronto, Canada, Sludge drying, *Energy conversion, Sludge burning, Steam.

The Toronto, Ontario, Lakeview waste water plant expansion plans include a system to burn dewatered sludge and recover the energy as steam. The process includes Zimpro thermal conditioning (wet oxidation), vacuum filtration, fluid bed furnaces, and waste heat recovery boilers. No additional fuel is needed to burn the sludge cake. In addition to fuel savings, sludge incineration will alleviate the problem of inadequate land for sludge disposal. (Cassar-FRC)
W81-03112

COMPOST FILTERS FOR H2S REMOVAL FROM ANAEROBIC DIGESTION AND RENDERING EXHAUSTS,
Auckland Farmer's Freezing Co-operative Co., Ltd. (New Zealand). Central Lab.
For primary bibliographic entry see Field 5D.
W81-03133

ON-SITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W81-03170

LAND APPLICATION OF WASTE WATER,
Nielson, Maxwell and Wangsgard, Salt Lake City, UT.
For primary bibliographic entry see Field 5D.
W81-03175

HEALTH EFFECTS ASSOCIATED WITH WASTE WATER TREATMENT AND DISPOSAL,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5D.
W81-03178

LAND TREATMENT USES SLUDGE AT MADISON, WISCONSIN,
Madison Metropolitan Sanitary District, WI.
For primary bibliographic entry see Field 5D.
W81-03189

CHARACTERIZATION AND AGRICULTURAL UTILIZATION OF SWINE WASTE LAGOON EFFLUENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 3C.
W81-03208

MONITORING FOR LAND APPLICATION OF WASTE WATER,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical Engineering.
D. B. Aulenbach, and N. L. Clesceri.
Water, Air, and Soil Pollution, Vol 14, p 81-94, 1980. 9 Fig, 18 Ref.

Descriptors: *Land disposal, *Infiltration, *Monitoring, Observation wells, Tracers, Unsaturated flow, Lysimeters, Lake George, *New York, Waste water disposal, Water pollution sources, Treatment facilities, Wells, Fluorescent dye, Path of pollutants, Tracing techniques, Infiltrometers, Dyes, Rhodamine, Disposal.

The Lake George Village, New York, Sewage Treatment Plant has been disposing of secondary effluent by land application using rapid infiltration since 1939. The groundwater monitoring system uses several methods of sample collection, as illustrated in a discussion of Sand Bed No. 11, one of 14 such beds at the facility. Seven well points are installed at 2, 4, 6, 8, 10, 12, and 14 ft depths; sample volumes from these are generally insufficient. Suction cup lysimeters at depths to 60 ft can obtain samples of about 900 ml. Shallow and deep observation wells extend to the saturated zone. Tracer studies showed that Rhodamine T was a more effective marker in these sand beds than tritium or salts such as NaCl and KCl. The author noted that horizontal collector wells might be useful in collecting samples in the unsaturated zone during periods of temporary saturation. (Cassar-FRC)
W81-03210

5F. Water Treatment and Quality Alteration

WATER TREATMENT PROJECT: OBSERVATIONS ON USE OF GAC IN PRACTICE,
Texas A and M Univ., College Station.
T. D. Reynolds, and S. J. Hawkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-203557, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/1-80-023, May, 1980. 31 p, 4 Fig, 1 Tab, 2 Ref, 1 Append. C 2557-NAEX.

Descriptors: *Water treatment, *Activated carbon, *Adsorbents, *Organic carbon, Water temperature, Drinking water, Chemical oxygen demand, Bacteria.

It has been suggested that the activated carbon adsorption process applied in drinking water practice may have contributed to the organic content of about 18% of the samples examined, particularly when the water temperature was above average in April. This project was designed to determine if granular activated carbon (GAC) adsorption beds applied in water treatment practice slough-off organic materials during the spring warm-up, and to evaluate the feasibility of the dilute or low-level COD procedure for the control of GAC beds in water treatment applications. Nine water treatment plants were studied for a period of five months during the spring of 1979. An evaluation of the COD and TOC removals versus water temperature showed that no temperature related trend in removal existed. The COD values determined by the low-level or dilute procedure correlated well with the TOC values. There was no appreciable slough-

ing off of bacterial growth from the filters during the spring warm-up period. (Brambley-SRC)
W81-02966

REMOVAL OF HALOMETHANES FROM WATER WITH OZONATION,
Rhode Island Univ., Kingston.
P. W. Chang, and C. E. Olney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-205106, Price codes: A02 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island, Completion Report, April, 1981. 15 p, 9 Tab. OWRT-A-072-RI(1).

Descriptors: *Ozonation, *Chlorination, *Chlorinated hydrocarbons, Water pollution control, *Drinking water, *Water pollution treatment, Water treatment, Ozone, Halogens, Chlorine, Residual chlorine, Waste water treatment, Hydrocarbons, Pollutants, Pollution load, Water pollution sources, Pollutant identification, Potable water, Water pollution, Water pollution sources, Organic compounds, Halomethanes.

In studying the reduction of trihalomethane (THM) in water by ozonation, it was observed that in the application of ozone by sparging, the sparging alone caused considerable THM reduction. Residual and dissolved ozone were used in THM treatment in order to better assess the oxidative effect of ozone. Under such conditions, oxidative losses of methyl iodide, chloroform, bromotrichloromethane, tetrachloroethylene, and trichloroethylene were 31, 32, 40, 56, and 97%, respectively. Experiments combining chlorination and ozonation on solutions of phenol, toluene, acetone, and methanol showed that sparging with ozone or oxygen for three minutes at zero degrees Centigrade and pH 7 reduced toluene levels, but had little effect on the total concentration of the other three water-soluble compounds. With all four compounds, ozone treatment alone does not produce any chloroform; however, chlorine treatment produced 400-870 part-per-billion chloroform. Ozone treatment of phenol and methanol prior to chlorination increased chloroform formation three- and six-fold, respectively, over that formed by chlorination alone. Ozonation after chlorination reduced chloroform from phenol and toluene by 63 and 43%, respectively. It appeared that ozone is a better drinking water disinfectant and reduces and limits THM formation. (Zielinski-IPA)
W81-03001

PROCESS FOR SLOW SOFTENING WATER,
Passavant-Werke Michelbacher Huette, Aarbergen (Germany, F.R.).
N. Berlenback, and F. Klegraf.
U.S. Patent No 4,209,395, 4 p, 2 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1392, June 24, 1980.

Descriptors: *Patents, *Water treatment, *Separation techniques, *Water softening, Calcium compounds, Flocculation, Chemical precipitation, Calcium carbonate, Industrial water.

An improved method of slow softening water considerably reduces the total treatment time and achieves complete reaction, precipitation and removal of calcium carbonate. In accordance with the invention, before entering the reaction zone and before being contacted with the flocculation agent, the water being softened is admixed with finely divided crystalline calcium carbonate. The admixture takes place in a mixing zone simultaneously with the addition of an alkaline compound. The finely divided crystalline calcium carbonate acts as an inoculant or seeding agent which accelerates restoration of the equilibrium in the reaction zone so that a fast and satisfactory reaction takes place before the salts containing trivalent metal ions are added to the liquid. The process provides for essentially complete reaction within the reaction zone and thus prevents calcium carbonate scaling in subsequent treatment stages of the plant. (Sinha-OEIS)
W81-03021

FLOCCULANTS FOR AQUEOUS SYSTEMS,
Kewanee Industries, Bryn Mawr, PA. (Assignee).
H. A. Green, J. J. Merianos, A. N. Petrocci, and M. Weinstein.
U.S. Patent No 4,209,397, 4 p, 6 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1393, June 24, 1980.

Descriptors: *Patents, *Water treatment, *Industrial water, Recirculated water, Separation techniques, Water purification, Flocculation, Coagulation, Chemical reactions.

In some industrial operations where the liquid circulates in a closed system, it is almost imperative to separate the emulsified, dispersed, or suspended impurities before the liquid is introduced into the closed recirculatory system because, otherwise, slow precipitation of the impurity would tend to block the line completely or, at least, act as a barrier to satisfactory liquid flow. It has now been discovered that both the 'capped' and 'terminated' polymeric quaternary ammonium compounds are excellent flocculants and coagulants in aqueous systems and are superior in their behavior as flocculants and coagulants to the 'non-capped', or 'non-terminated' polymers. (Sinha-OEIS)
W81-03023

WATER TREATING PROCESS,
Kurita Water Industries Ltd., Osaka (Japan). (Assignee); and Sanyo Chemical Industries Ltd., Kyoto (Japan). (Assignees).
M. Ii, Y. Goto, T. Suzuki, and S. Kubo.
U.S. Patent No 4,209,398, 11 p, 6 Tab, 16 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1393, June 24, 1980.

Descriptors: *Patents, *Water treatment, *Scaling, Corrosion, Industrial water, Cooling water, Polymers, Organic compounds.

A water treating agent comprises a specific polymer containing a structural unit that is derived from a monomer having an ethylenically unsaturated bond and has one or more carboxyl radials, at least a part of the carboxyl radicals being modified. The water treating agent comprises, in addition to the specific polymer, one or more compounds selected from the group consisting of inorganic phosphates, phosphonic acids, organic phosphoric acid esters and polyvalent metal salts. It is capable of preventing the formation of corrosion, scale and contamination on the surface of a metal that is in contact with water. (Sinha-OEIS)
W81-03024

REMOTE CONTROL VALVE FOR REVERSE OSMOSIS WATER PURIFIER,
J. Astl.
U.S. Patent No 4,210,533, 10 p, 10 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 233, July 1, 1980.

Descriptors: *Patents, *Water treatment, *Reverse osmosis, *Water purification, Remote control, Control systems, Domestic water, Equipment.

A remote control valve regulates a reverse osmosis water purifier with only fluid connections between the control valve and the water purifier. The control valve includes a valve body having a purified water inlet, a brine inlet and a brine return outlet all connectible to the water purifier. The purified water nozzle means connects the purified water inlet to the water discharge outlet and bypasses the purified water bleed means when the brine inlet valve is open to discharge purified water. A check valve is provided for preventing brine flow through the waste outlet when the brine inlet valve is open. A brine bleed means comprises a passage through the brine inlet valve. An air gap means is provided in the control valve for preventing contamination of the water purifier in the event of drain blockage. (Sinha-OEIS)
W81-03033

NUMERICAL MODEL DESCRIBING GROUNDWATER TREATMENT BY RECHARGE OF OXYGENATED WATER,
Hanover Univ. (Germany, F.R.). Inst. of Water Resources, Hydrology and Agricultural Engineering.
P. W. Boochs, and G. Barovic.
Water Resources Research, Vol 17, No 1, p 49-56, February, 1981. 10 Fig, 12 Ref.

Descriptors: *Oxygenation, *Recharge wells, Wells, Groundwater recharge, Iron, Manganese, Model studies, Mathematical models, *Water treatment, Metals, Aquifers, Injection wells, Precipitation(Chemical).

The quality of groundwater rich in iron and manganese, common in coastal areas of northern Germany, may be improved by recharging oxygen-rich water using injection wells. This process can be 10 times cheaper than surface treatment in which the Fe and Mn are oxidized, precipitated, and filtered in special equipment. Both mathematical model and field observations were used to determine the oxygen demand for oxidizing Fe(2+) within the aquifer. In one trial two wells were alternated between recharge and pumping out for water supply. When iron concentrations reached a certain limit, the wells were switched. Factors affecting the method's economy were iron content, pumping to recharge ratio, and properties of the aquifer. (Cassar-FRC)
W81-03055

A PILOT STUDY OF CHLORINE DIOXIDE USE TO REDUCE TOTAL TRIHALOMETHANES,
Southern Nevada Water System, Boulder City. Las Vegas Valley Water District.
J. T. Monscvitz, and D. J. Rexing.
Journal of the American Water Works Association, Vol 73, No 2, p 94-96, February, 1981. 7 Fig, 1 Tab, 5 Ref.

Descriptors: *Chlorine dioxide, *Water quality control, Water purification, Disinfection, *Water treatment, *Louisville, Kentucky, Aquatic microorganisms, Bacteria, Microorganisms, Chlorination, Trihalomethanes.

This article relates the design considerations and problems encountered in the production of chloride dioxide free of chlorine. A plan was developed to construct a chlorine dioxide reactor large enough to treat 189 ML/d in the 757 ML/d plant. The first major problem was that the first venturi (mixing) did not provide sufficient vacuum or negative pressure to deliver the chlorine dioxide solution to the diffuser at the chemical application point. Therefore, a second, larger venturi was placed downstream from the first venturi. The second major problem arose when the estimate of 189-ML/d production was far too small for the actual 389 ML/d production which occurred, making the original generating system inadequate. A pilot scale operation was established, operating at 3.8 L/min. The system consisted of a 4.54 kg/day chlorinator, a variable peristaltic pump to feed a 25% solution of NaClO2, and a reaction column sized to provide 10 min of empty bed contact time and filled with 1.27-cm unglazed porcelain Raschig rings. The pilot study indicated that high yields of chlorine dioxide can be obtained using stoichiometric ratios of chlorine and NaClO2. (Baker-FRC)
W81-03074

USE OF CHLORINE DIOXIDE, CHLORAMINES, AND SHORT-TERM FREE CHLORINATION AS ALTERNATIVE DISINFECTANTS,
Louisville Water Co., KY.
S. A. Hubbs, D. Amundsen, and P. Olthius.
Journal of the American Water Works Association, Vol 73, No 2, p 97-101, February, 1981. 8 Fig, 9 Ref.

Descriptors: *Water quality control, *Chlorination, *Chloramination, Water purification, Disinfection, *Water treatment, *Louisville, Kentucky, Aquatic microorganisms, Bacteria, Microorganisms.

Two alternative disinfection processes in use at the Louisville, Kentucky, Water Company are described, as well as the theory behind their use,

design, and effectiveness in controlling bacteria. The basic treatment process at the plant includes presedimentation; coagulation-flocculation-sedimentation with alum and polymer; softening-stability control with lime, soda ash, and carbon dioxide; rapid sand filtration; and fluoridation. After investigation of several disinfection schemes, it was decided that the most effective process incorporates the use of a powerful disinfectant for the primary disinfection step, followed by a persistent secondary disinfectant that is carried into the distribution system. The chlorine dioxide system effectively limited the trihalomethane production to less than 5 microgram/L. Economic considerations and proven confidence in free chlorine as a disinfectant led to the decision to use the short-term free chlorination system, followed by ammoniation to produce monochloramine. (Baker-FRC)
W81-03075

EXPERIENCE WITH CHLORAMINES AS PRIMARY DISINFECTANTS,
Philadelphia Suburban Water Co., Bryn Mawr, PA.
K. E. Shull.
Journal of the American Water Works Association, Vol 73, No 2, p 101-104, February, 1981. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Chloramines, Water quality control, *Coliforms, Water purification, *Disinfection, *Water treatment, Pickering Creek, *Philadelphia, Aquatic microorganisms, Bacteria, Microorganisms.

The treatment and excellent bacteriological results obtained by the Philadelphia Suburban Water Company during five decades of chloramine treatment at its Pickering Creek plant are described. The PSWC supplies water in an area of 736 square kilometers to a population of over 850,000. The principal sources of supply are four rural streams that are tributaries to the Schuylkill and Delaware Rivers. These sources are Crum Creek, Pickering Creek, Perkiomen Creek and Neshaminy Creek. Pickering is the only water treatment plant using chloramine pretreatment exclusively for disinfection. At this plant, water from the two primary sources, Green Lane Reservoir and Pickering Creek, and occasionally from the auxillary source, the Schuylkill River, enters the pretreatment building from two pipes into a flume. Here the water receives an application of aqua ammonia which is followed by a chlorine dosage, usually at a 1:3 ratio. Liquid alum is used for coagulation, and powdered activated carbon for taste and odor control. Following rapid mixing and flocculation, the water flows into and through a sedimentation basin, where the alum floc, heavy with clay and other impurities as well as with carbon and its absorbed impurities, settles out. The supernatant is filtered through rapid sand filters. Advantages and disadvantages of the use of chloramines as disinfectants are discussed. (Baker-FRC)
W81-03076

THE ANATOMY OF AN OZONE PLANT,
Michigan Water Treatment Plant, Monroe.
W. L. LePage.
Journal of the American Water Works Association, Vol 73, No 2, p 105-111, February, 1981. 1 Fig, 9 Tab, 9 Ref.

Descriptors: *Ozonation, *Water quality control, Odor, Taste, Cost analysis, Design criteria, *Water treatment, Chlorination, Water purification, Trihalomethanes, Monroe, *Michigan.

The design, equipment, and operating record of the successful ozone installation at the water treatment plant in Monroe, Michigan are described. After the ozonation system was added to the treatment scheme, which was simultaneously enlarged, the new treatment capacity was 68 million liters per day (18 mgd). The primary objective of ozonation was odor and taste reduction, but the potential value of the supplementary benefits was also considered. Details are given as to the design, construction, control mechanisms, system checks, safety measures, preoperational changes, personnel training, and system startup concerning this particular installation. The effectiveness of the ozonation has been without question. After continuous ozonation had started, taste and odor complaints dropped from a high of 100 on a single day to none. Additional benefits included a reduction of chlorine demand, partial or complete disinfection, improved alum coagulation and settling, destabilization of certain colloids, and cyanide destruction. Total trihalomethanes appeared substantially lower, and trihalomethane formation potential dropped 40 to 50%. Total disinfection of raw water is attained by ozonating to a control residual of 0.3 mg/liter ozone at the outlet of the contactor. System costs are also reviewed. (Baker-FRC)
W81-03077

EVALUATING COSTS AND BENEFITS OF ALTERNATIVE DISINFECTANTS,
Environmental Protection Agency, Cincinnati, OH.
R. M. Clark.
Journal of the American Water Works Association, Vol 73, No 2, p 89-93, February, 1981. 15 Fig, 12 Tab, 7 Ref.

Descriptors: *Cost-benefit ratio, *Water quality control, *Disinfection, Water purification, Cincinnati water works, *Water treatment, Aquatic microorganisms, Bacteria, Microorganisms, Chlorination, Filtration.

Historically documented costs and benefits associated with chlorination alone and in combination with filtration are presented. General cost characteristics of chlorination and alternative methods of disinfection; a comparison of costs among disinfectants at presumed equivalent dosages; and a comparison of energy utilization among alternative disinfection processes are also discussed. A comparison is made of the costs and benefits associated with the alternative disinfectants on a common basis. The analysis presented is based on the records of the Cincinnati Water Works and the Hamilton County, Ohio Health Department. The study demonstrated that disinfection and the combination of disinfection and filtration are highly cost-effective preventive public health practices. When various disinfectants are compared on the basis of dosage and energy comsumption, chlorine is probably the cheapest disinfectant. In terms of incremental dosage, chlorine has the lowest marginal cost per unit increase in concentration. The costs of other disinfectants are only slightly higher, however, than that of chlorine, and disinfection on any basis shows a favorable cost-benefit relationship. (Baker-FRC)
W81-03078

ALTERNATIVE FILTRATION METHODS FOR REMOVAL OF GIARDIA CYSTS AND CYST MODELS,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
G. S. Logsdon, J. M. Symons, R. L. Hoye, Jr., and M. M. Arozarena.
Journal of the American Water Works Association, Vol 73, No 2, p 111-118, February, 1981. 9 Fig, 7 Tab, 11 Ref.

Descriptors: *Water quality control, *Filters, *Protozoa, Filtration, *Water treatment, Waste water treatment, Water purification, Microorganisms, Giardia cysts.

In efforts to improve the removal of Giardia cysts from drinking water, a study was conducted to learn whether a relationship existed between cyst removal or cyst concentration in filtered water and the turbidity of filtered water. The study also aimed to identify treatment procedures and operational problems that might allow cysts to pass through filters and to discover the cyst removal capabilities of well-operated filters. The studies suggest, through the use of cyst models, that properly operated water filtration plants should remove a high percentage of Giardia lamblia cysts. In order for effective cyst removal to occur, diatomaceous earth filters need 1.0 kg sq m diatomite precoat plus body feed, and granular media filters need coagulation of raw water and production of filtered turbidity well below 1.0 normal turbidity units throughout the entire filter run. (Baker-FRC)
W81-03079

REACTION OF FREE CHLORINE WITH HUMIC SUBSTANCES BEFORE AND AFTER ADSORPTION ON ACTIVATED CARBON,
Illinois Univ. at Urbana, Champaign. Dept. of Civil Engineering.
J. J. McCreary, and V. L. Snoeyink.
Environmental Science and Technology, Vol 15, No 2, p 193-197, February, 1981. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Humic acids, *Chlorination, *Organic compounds, Potable water, Activated carbon, Chemical reactions, Water purification, Water pollution sources, Organic matter, *Water treatment.

Reaction of humic acid with aqueous free chlorine produced no compounds different from those formed by chlorine reaction with humic substances adsorbed on activated carbon. In fact, the concentrations of compounds in the effluent from the carbon column were less than in the humic acid-chlorine reaction without carbon. Concentrations of influent chlorine ranged from 2.45 to 13.3 mg per liter, similar to those experienced in municipal water treatment plants. Apparently, most of the Cl reacted with the carbon and not with the adsorbed organic materials. Some of the 33 organic compounds detected in the effluent were phenones (aceto-, para-ethyl aceto-, and benzo-), benzoates (methyl, 3,5-dimethyl, and several unidentified), benzaldehyde derivates, propylene glycol, 2-ethyl hexanal, naphthalene, anthracene, octanoic acid, phenols (monochloro-, dichloro-, trichloro-, methoxy dichloro-, and tetramethyl-), lactic acid, and hydroquinone. (Cassar-FRC)
W81-03086

ORGANIC COMPOUNDS PRODUCED BY THE AQUEOUS FREE-CHLORINE-ACTIVATED CARBON REACTION,
Illinois Univ. at Urbana-Champagin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W81-03087

INVESTIGATIONS OF SOLVENT-REGENERABLE CARBON-SULFUR SURFACE COMPOUNDS FOR PHENOL REMOVAL IN A PACKED COLUMN,
Exxon Research and Engineering Co., Linden, NJ.
C. H. Chang, and D. W. Savage.
Environmental Science and Technology, Vol 15, No 2, p 201-206, February, 1981. 5 Fig, 5 Tab, 15 Ref.

Descriptors: *Phenols, *Water treatment, *Activated carbon, Sulfur, Aromatic compounds.

The removal of phenol from aqueous solution by carbon-sulfur surface compounds, CxS, and the regeneration of the spent adsorbent with organic solvents in a continuous, down-flow column is described. Parallel studies were made on Filtrasorb 300 and Ambersorb XE-340, which is a carbonized synthetic resin whose chemical composition is intermediate between that of activated carbon and polymeric adsorbents. Studies conducted at room temperature showed that the CxS has a virgin capacity of 8.1 lb/cubic foot with an influent concentration of 2000 ppm at a flow rate of about 10 bed volumes per hr. Regeneration of the adsorbent with 2.0 bed volumes of 2-propanol restores 90% of its capacity. In the Filtrasorb 300 experiments the activated carbon had an initial capacity of 5.6 lb/cubic foot, and its capacity fell gradually to 4.1 lb/cubic foot after several cycles. The difference in regenerability between CxS and the activated carbon is attributed to the difference in surface groups. (Baker-FRC)
W81-03097

STUDY OF THE CHLORINATION OF ARTIFICIAL SEAWATER. (ETUDE PHYSICOCHIMIQUE DE LA CHLORATION DE L'EAU DE MER ARTIFICIELLE),

Universite de Bretagne-Occidentale, Brest (France). Lab. de Chimie Analytique.
A. Peron, and J. Courtot-Coupez.
Water Research, Vol 14, No 4, p 329-332, April, 1980. 2 Fig, 1 Tab, 19 Ref.

Descriptors: *Chlorination, *Seawater, *Chemical reactions, *Industrial water, Cooling water, Fouling, Bromine.

The nature and evolution of chemical species which can occur with the introduction of chlorine into sea water were determined. These studies were part of a program to evaluate the influence on marine flora and fauna of chlorination, used to prevent the attachment of marine organisms in industrial cooling circuits using sea water as the coolant. Experiments were made in ammonia-free artificial or UV-photooxidized demineralized sea water to avoid slow reactions of chlorine and bromine with organic compounds in sea water. Hypochlorite was added to the water at chlorine concentrations of 0.5 to 1 mg/l, analogous to those used industrially. Experiments were made at a temperature of 18C and in the absence of light. The results obtained from bromine determinations, using phenol red as a reagent, and from electronic absorption spectra of chlorinated sea water show a fast and quantitative oxidation of bromide ions to hypobromite and hypobromous acid. No bromate formation was detected under the experimental conditions. (Hertzoff-FRC)
W81-03110

THE NAS WATER TREATMENT CHEMICAL STUDY...WHAT IS ITS APPROACH. WHERE WILL IT LEAD.,
St. Louis County Water Co., MO.
C. A. Buescher.
Water/Engineering and Management, Vol 128, No 1, p 20, January, 1981.

Descriptors: *Drinking water, *Water treatment, Sulfates, Chlorides, *Standards, Fluorides, Coagulation, Flocculation, Dispersants, Disinfectants, Oxides, Precipitation, *National Academy of Sciences.

The minimum acceptable purity requirements for substances used in the treatment and distribution of drinking water are under study by the National Academy of Sciences. The committee has divided water treatment chemicals into four major groups: coagulants and flocculants, disinfectants and oxidizers, precipitants and softeners, and a miscellaneous group of reagents including hydrofluosilicic acid, sodium silicofluoride, sodium fluoride, activated carbon, and phosphates. The study will result in the formulation of purity specifications and associated testing methodology to ensure that if a 'codex' chemical is used in normal doses, harmful substances will not be added by the chemical to the drinking water. (Baker-FRC)
W81-03141

PHYSICOCHEMICAL STUDY OF THE CHLORINATION OF ARTIFICIAL SEA WATER CONTAINING AMMONIACAL NITROGEN. (ETUDE PHYSICOCHIMIQUE DE LA CHLORATION DE L'EAU DE MER ARTIFICIELL CONTENANT DE L'AZOTE AMMONIACAL),
Universite de Bretagne-Occidentale, Brest (France). Lab. de Chimie Analytique.
A. Peron, and J. Courtot-Coupez.
Water Research, Vol 14, No 7, p 883-890, July, 1980. 6 Fig, 2 Tab, 31 Ref.

Descriptors: *Chlorination, *Seawater, *Nitrogen compounds, Chemical reactions, Laboratory studies, Chloramines, Bromine, Organic compounds, *Cooling water, Industrial water.

Chlorination of sea water containing nitrogen was studied in view of the presence of nitrogen in the sea water used as a coolant at coastal industrial installations where chlorination prevents algal and marine organism encrustation of circuits. The relative importance of monochloramine formation and bromine oxidation to bromamines was estimated from electron absorption spectra of chlorinated sea water. Preliminary experiments in artificial and UV photosensitized sea water avoided substitution reactions occurring in the presence of organic compounds. Results were very different depending on the molar ratio of added chlorine to nitrogen. With $Cl/N > 1.5$, only bromine derivatives were obtained: dibromamine, tribromamine and some monobromamine; monochloramine predominated when ammonium concentrations reached higher values. The stoichiometry of ammonia to nitrogen oxidation by chlorine explains this ratio of 1.5, and a strong decrease in total oxidant concentration occurred under these conditions. Bromamines decomposed within 30-60 min, leaving only stable bromine(I) or monochloramine. The differences in behavior between artificial and real sea water are due to oxidation and substitution by hypochlorite and hypobromite in organic compounds present in natural sea water. (Hertzoff-FRC)
W81-03145

DISINFECTION,
Rensselaer Polytechnic Inst., Troy, NY.
C. N. Haas, and J. P. Gould.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1224-1232, June, 1980. 1 Tab, 94 Ref.

Descriptors: *Disinfection, *Water purification, *Literature reviews, Chlorination, Ultraviolet radiation, Ozone, *Water treatment, Water quality, Trihalomethanes, Analytical techniques, Aquatic life, Fish, Toxicity, Microorganisms, Chemical reactions.

A review of papers on disinfection of potable water include studies on the action of chlorine, ozone, ultraviolet radiation, chlorine dioxide, and other agents on microorganisms. The effects of disinfectants on fish and marine animals are described. Other topics covered are the chemistry of oxidants, trihalomethanes, and analysis of chlorine and ozone in aqueous solutions. (Cassar-FRC)
W81-03172

MANAGEMENT OF WATER QUALITY AND TREATMENT,
Salem and Beverly Water Supply Board, Beverly, MA.
J. K. Reilly.
Journal of the New England Water Works Association, Vol 94, No 4, p 304-308, 1980. 3 Ref.

Descriptors: *Metropolitan water management, *Water supply, Public health, *Water treatment, Water quality management, Water treatment facilities, Waste water facilities, Massachusetts.

Management of raw water supplies and of water treatment facilities to produce a safe water supply for a community are discussed. Contamination of the raw water supply must be controlled to reduce the burden on the treatment plant. Many community water supplies in New England have become contaminated by sodium as well as by trichloroethylene and other organics common in industry today. Technology, regulations and standards are needed to solve this type of problem. Advances in water treatment technology can treat contaminated water, or standards and regulations can be used to help avoid contamination in the first place. The public's health and well-being are dependent upon control of water quality and proper management of treatment facilities. (Small-FRC)
W81-03219

5G. Water Quality Control

WATER PURIFICATION SYSTEM,
R. E. Flatow.
U.S. Patent No 4,204,956, 8 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 994, No 4, p 1362, May 27, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, Disinfection, *Ultraviolet radiation, Ozone, *Microorganisms.

The system employs high intensity germicidal ultraviolet lamps in a tank that need not be pressurized and through which water is passed for killing all or substantially all microorganisms in the water. These lamps are closely spaced crosswise to water flow without any baffles or other ultraviolet attenuators. Detectors in the tank monitor ultraviolet radiation and a movable top with interlocks allows safe access to the tank interior. For applications, such as water purification for human consumption, the invention employs an ultraviolet lamp which emits germicidal wavelengths and ozone producing wavelengths. It has been found that a synergistic effect is produced by the combination of ozone and high intensity germicidal ultraviolet which is extremely effective in killing microorganisms in water. (Sinha-OEIS)
W81-02913

DEMONSTRATION OF DEBRIS BASIN EFFECTIVENESS IN SEDIMENT CONTROL,
Kimball (L. Robert) and Associates, Ebensburg, PA.
R. E. Bednar, and D. J. Fluke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-222730, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/PS7-80-154, September, 1980. 3 p, 1 Fig. S-801276.

Descriptors: *Strip mine wastes, *Sediment control, *Coal mining, *Debris basins, Strip mines, Sedimentation basins, Suspended solids, Water quality control, Storm runoff, Roads, Spillways.

In order to determine the effectiveness of sedimentation ponds, as built during the mid-1970's, in the removal of suspended solids discharged in the runoff from lands disturbed by a typical surface mine, two similar and adjacent watersheds in eastern Kentucky were selected for study. Mining was proposed in only one valley (Rhoades Branch). The adjacent control watershed (Dick Branch) was selected to provide background data on water quality where man's activities continue to be limited. Mining activities began with construction of a haul road and nine debris basins in August 1976 and were halted by a strike in December 1977. During this period, only four of the basins received runoff from disturbed areas. Monitoring showed that efficiency was much lower during storm events than during normal flows, due in part to construction and maintenance practices. With time, efficiency of the basins decreased due to a lack of maintenance. Clogging of outflow pipes by floating debris and accumulated sediment caused excess use and rapid deterioration of the emergency spillway and embankment, and short circuiting of the ponds. By the fall of 1977, the main sediment basin on Rhoades Branch upstream of the monitoring station had completely filled, and was not cleaned out. (Moore-SRC)
W81-02936

WATER INFILTRATION CONTROL TO ACHIEVE MINE WATER POLLUTION CONTROL - THE DENTS RUN WATERSHED DEMONSTRATION PROJECT,
Industrial Environmental Research Lab., Cincinnati, OH.
J. G. Herrmann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-217748, Price codes: A09 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/PS7-80-128, October, 1980. 6 p, 4 Fig, 2 Tab.

Descriptors: *Land reclamation, *Acid mine drainage, *Water pollution control, *Infiltration, *Coal mines, Mine drainage, Strip mines, Mine wastes, Surface runoff, Water pollution sources.

One of the most severe mine drainage problems encountered in the Appalachian coal fields is the discharge of highly acidic and iron-bearing drainage from abandoned underground mines. This problem is aggravated by surface water frequently draining into both active and abandoned mines and exposed auger holes. The objective of the Dents Run Watershed Demonstration Project was to demonstrate the effectiveness of surface mined

land reclamation measures in establishing surface water infiltration control to prevent or reduce pollution from acid mine drainage. The project was initiated with a comprehensive field investigation of the Dents Run Watershed in West Virginia to locate and characterize each mine site and underground mine opening. Based on this information and detailed analyses of regional geologic conditions and past mining history, areas of suspected high infiltration were identified. Site-specific reclamation plans and specifications were then prepared. Over 40 hectares of surface mines were reclaimed during this project and nearly 100% of the pollutional drainage was eliminated. (Moore-SRC)
W81-02940

LAWRENCE AVENUE UNDERFLOW SEWER SYSTEM, INTERIM REPORT, PLANNING AND CONSTRUCTION,
Chicago Dept. of Public Works, IL. Bureau of Engineering.
J. Koncza, D. H. Churchill, and G. L. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-145708, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-014, March, 1980. 88 p, 37 Fig. 11020 EMD.

Descriptors: *Combined sewer overflows, *Sewer systems, *Urban drainage, *Tunnel construction, *Storm runoff, Planning, Cost analysis, Water storage, Water pollution control, Underground storage.

A new concept in design of urban drainage systems was developed as a step forward in the solution of combined sewer overflow problems. A deep tunnel in bed rock about 200 to 250 feet (61 to 76 m) below the surface was designed and constructed for the Lawrence Avenue drainage basin in Chicago. Utilization of modern tunnel boring machines made the project economically competitive with conventional sewers while reaping additional benefits of ease in construction, no disturbance to traffic and least inconvenience to public. In addition, the tunnel sewer will serve as a reservoir totally capturing smaller storms, and trapping a significant portion of the first flush of pollutants from larger storms. The entrapped pollutional load will be pumped to a treatment plant through a pumping station to be operated only at the end of the storm, for dewatering the tunnel. The project is expected to reduce, to a large extent, the combined sewer overflows to the waterways. Hydraulic model studies were conducted for the design of drop-shafts to convey wet weather flows from surface sewers to the deep tunnel. Preconstruction field measurements on the quantity and quality of combined sewer overflows were collected for a number of storms for three outfalls serving the Lawrence Avenue drainage basin, for comparison with measurements made when the tunnel is in complete operation. This comparison will be used to demonstrate the effectiveness of this concept in reducing pollution to waterways from combined sewer overflows. (Brambley-SRC)
W81-02950

SURFACE CONTAINMENT FOR GEOTHERMAL BRINES,
TRW, Inc., Redondo Beach, CA.
R. Sung, W. Murphy, J. Reitzel, L. Leventhal, and W. Goodwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-169246, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/7-80-024, February, 1980. 54 p, 9 Fig, 8 Tab, 17 Ref. 68-03-2560.

Descriptors: *Geothermal power, *Brines, *Thermal powerplants, *Water pollution prevention, Accidents, Maintenance, Ponding, Geothermal resources.

As plans are developed for power plants using liquid-dominated geothermal resources, the probability and prevention of significant releases of geothermal brine to the surface environment through unplanned or accidental events must be considered. Three geothermal energy conversion systems were selected for detailed analysis: a 360 F double flash system; a 360 F brine binary system; and a 550 F multiflash binary system. Flow rates for a 50 MWe power plant range from 1,000 gpm to 14,000 gpm, so that flow rates of inadvertent releases range from a trickle to 14,000 gpm, depending on the failure which causes the release. For a 40 yr plant life, the probability of a large spill is estimated to be 1 in 500, while trickle spills are a virtual certainty. The three means of containing an inadvertent release and minimizing environmental damage are: minimizing the potential for component failure, limiting release duration, and limiting the affected area. Minimizing the potential for component failure is a matter of: using materials of good engineering design, incorporating component redundancy, and minimizing the number of components; proper maintenance and replacement; and security to prevent wanton damage. Release time can be minimized with an adequate brine shut-off system, using automatic or manual valves. Ponding is recommended to limit the size of the affected area. (Brambley-SRC)
W81-02955

APPLICATION OF BUOYANT MASS TRANSFER MEDIA TO HAZARDOUS MATERIAL SPILLS,
Battelle Pacific Northwest Lab., Richland, WA.
G. W. Dawson, J. A. McNeese, and J. A. Coates.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-198427, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-078, May, 1980. 45 p, 11 Fig, 14 Tab, 6 Ref. 68-03-2204.

Descriptors: *Cleanup operations, *Diazinon, *Activated carbon, *Mass transfer, *Hazardous materials, Adsorbents, *Water pollution treatment, Dispersants, Organophosphorus pesticides, Pesticides, Slurries, Accidental spills.

A prototype system was designed and developed to slurry buoyant activated carbon into a static body of water. The process was developed to remove soluble hazardous compounds from a watercourse as the result of an accidental spill or chronic problem. The basic system was barge-mounted with an intake pump, a jet-slurrier, a surge tank, and a slurry pump. The buoyant carbon was fed into the slurrier by gravity from a floating, hopper-bottom tote bin. Containerized bins can be used to ferry large volumes of buoyant carbon to slurry systems. The slurry system works better with slurrier and carbon feed above water, rather than below water. In a simulated spill, up to 98% of Diazinon was achieved by adsorption on activated carbon and by dispersion of the spilled material. Since no acceptable buoyant activated carbon is commercially produced in the United States at this time, a method of making buoyand activated carbon by using glass microballoons and a carbon coating mix was developed. Estimated cost per pound of media was $3.50 on a small-batch basis. (Moore-SRC)
W81-02959

PATHOGENICITY OF CERCOSPORA RODMANII CONWAY ON EICHHORNIA CRASSIPES (MART.) SOLMS IN NATCHITOCHES PARISH, LOUISIANA,
Northwestern State Univ. of Louisiana, Natchitoches. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W81-02974

RESERVOIR RELEASE WATER QUALITY IMPROVEMENT BY LOCALIZED DESTRATIFICATION,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
K. M. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-203145, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, May, 1981. 86 p, 30 Fig, 11 Tab, 30 Ref, 3 Append. OWRT-B-043-OKLA(1).

Descriptors: *Reservoir releases, *Reservoir operation, *Water quality control, *Destratification, *Thermal stratification, Pump testing, Flow control, Reservoirs, Water storage, Water supply, Water conveyance, Reservoir storage, Quality control, Water quality, Water quality management, Stratification, Pumps, Propellors, Rotors, Trace elements, Trace metals, Ammonia, Sulfides.

Performance of the axial flow Garton pump was evaluated as a means of improving release water quality from reservoirs that experience thermal stratification and are not equipped with multi-level withdrawal structures. The study sought to determine optimum pump performance (by varying reservoir release rate relative to pump discharge rate), and evaluate pump performance (by varying propellor diameter: 1.22, 1.83, and 2.44 meters). The propellor, 1.7 meters below water surface, pumped high quality epilimnion water down to the outlet in the hypolimnion. Various chemical/physical properties were monitored with/without pumping. The Garton pump was found an effective and simple device for in-lake improvement of reservoir release water quality. Pump operation over a low level intake increased release water temperature and water quality. Maximum observed improvements for total iron, manganese, ammonia-nitrogen, and sulfides were 39%, 80%, 37%, and 68%, respectively. Increasing pump diameter at constant discharge velocity sufficient to penetrate to outlet depth, increased discharge rate and ratio of surface water released to total release rate (dilution factor). Optimum release water quality improvements were obtained at ratios of pumping rate to release rate of 0.47-0.96. (Zielinski-IPA)
W81-03005

OIL SPILL CLEANUP METHOD AND APPARATUS,
Suntech, Inc., Philadelphia, PA. (Assignee).
F. M. Mayes.
U.S. Patent No 4,209,400, 6 p, 3 Fig, 11 Ref; Official Gazette of the United States Patent Office, Vol 995, No 4, p 1394, June 24, 1980.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water quality control, Barriers, Floating, Equipment, Oil recovery, Containment, Hovercraft.

The object of this invention is to provide a means to effectively clean up oil spills, particularly in obstructed or shallow areas which have generally been inaccesible by floating devices. The invention comprises partially surrounding a hovercraft with a floating oil-containment barrier, there being no barrier at the front of the hovercraft. This horseshoe shaped oil-barrier dam is supported by telescoping outriggers which allows the varied undulations of craft and dam which will occur, but permits the barrier to maintain an oil seal along its perimeter in contact with the water. The oil on the water's surface is directed within the barrier and concentrated by means aboard the hovercraft to direct air exiting from under the skirts of the vessel onto the floating oil to sweep it into the barrier area for recovery. Collected oil is conducted to storage tanks aboard the craft through a suction line. (Sinha-OEIS)
W81-03026

MAGNETIC TREATMENT DEVICES FOR WATER PIPELINES,
G. Risk.
U.S. Patent No 4,210,535, 6 p, 8 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 233-234, July 1, 1980.

Descriptors: *Patents, *Water treatment, *Domestic water, Water quality control, Water softening, Ions, Magnetic studies, Polarity, Magnets.

Magnetic treatment devices are adapted for installation in pipeling systems extending from a reservoir of ion-laden water and terminating remotely downstream at the consumer's water-tap or other outlet-valve. The water treatment device comprises spaced-apart magnetic poles of opposite polarity for altering the water ionic characteristics. The magnetic poles are maintained alongside the pipeline segment with novel holding, anchoring,

and mounting means. There is also the provision to ensure a grounded condition for the magnetic poles if the pipeline segment is not grounded. (Sinha-OEIS)
W81-03035

WATER SCREEN,
S. S. Shiban.
U.S. Patent No 4,210,539, 7 p, 9 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 996, No 1, p 235, July 1, 1980.

Descriptors: *Patents, *Water quality control, *Water pollution control, Screens, Filtration, Water utilization, Recycling, Suspended solids, Industrial water, Backwashing.

Many industrial operations have found it economically advisable to recycle large volumes of water with the water being stored in a settling pond or other reservoir. Debris in the body of water in the form of suspended solids above a certain size must be screened or filtered out prior to water reuse. A rotatable water screen is described for submergence intermediate the upper and lower limits of the body of water and suitable for placement on the inlet end of a pump intake or suction conduit to remove suspended matter from the body of water outflow. A support structure of the water screen journals the drum for rotation. A backwash drive system comprises multiple conduits each having a series of spray orifices emitting directionalized sprays. A source of backwash water may conveniently be a valve regulated flow bled from the pressure side of a pump drawing filtered water through the water screen. A modifed form of the water screen, particularly suited for higher volumes is of somewhat greater screen area and utilizes a motor for drum rotation. (Sinha-OEIS)
W81-03036

ENHANCEMENT OF THE SURVIVAL OF RAINBOW TROUT (SALMO GAIRDNERI) EGGS AND FRY IN AN ACID LAKE THROUGH INCUBATION IN LIMESTONE,
Ontario Ministry of Natural Resources, Sudbury.
J. M. Gunn, and W. Keller.
Canadian Journal of Fisheries and Aquatic Science, Vol 37, No 10, p 1522-1530, October, 1980. 4 Fig, 4 Tab, 44 Ref.

Descriptors: *Trout, *Acidic water, Reproduction, *Fish reproduction, Limestones, Hatching, Incubation, Rainbow trout, Cold-water fish, Lakes, Wildlife, Growth stages, Fish eggs, Fry, Water pollution effects, Neutralization, George Lake, *Ontario, Hydrogen ion concentration.

Rainbow trout, Salmo gairdneri, eggs incubated and hatched within boxes (60 x 60 x 30 cm) containing crushed limestone placed in a sheltered spot in acidic (pH 5.3) George Lake, Ontario, showed 86.9 and 70.9% survival for eyed eggs and sac fry respectively. Eggs placed in more disturbed water had a hatching rate of 54.7% for eggs and a survival rate of sac fry, 23.2%. Eggs placed in boxes with noncalcareous gravel had only 11.2-57.1% survival rates for eggs and 0.2-0.4% for sac fry. Results in a control lake, pH near neutral, were 93.7-97.9% survival. Alevins hatched within limestone boxes were released into ambient, acidic lake water. During 5 days' holding, 65.2-78.8% died. In water of pH 5.6-5.9, 48.0% died; and in water of pH 6.1-6.3, only 2.0%. These findings indicate that rainbow trout eggs and alevins are more sensitive to lowered pH than previous data indicate. The lower tolerance limit may be pH 5.5-6.0. (Cassar-FRC)
W81-03115

TERATOGENESIS IN LAKE TROUT (SALVELINUS NAMAYCUSH) IN AN EXPERIMENTALLY ACIDIFIED LAKE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W81-03116

DREDGING VESSEL,
Ballast-Nedam Groep, N.V., Amstelveen (Netherlands). (Assignee); and Amsterdamse Ballast Bagger en Grond (Netherlands).
For primary bibliographic entry see Field 8A.
W81-03154

ANAEROBIC PROCESSES,
Institute of Gas Technology, Chicago, IL.
K. F. Fannin, D. P. Chynoweth, S. Ghosh, and V. J. Srivastava.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1182-1195, June, 1980. 1 Tab, 88 Ref.

Descriptors: *Anaerobic bacteria, *Biodegradation, *Reviews, Anaerobic conditions, *Biological treatment, Digestion, Bacteria, Microbiological studies, Microbial degradation, Sludge digestion.

Recent research on anaerobic processes as they relate to water pollution is cited in this literature review. Studies grouped under the general heading of microbiology dealt with classification and characterization of methanogenic bacteria, the viability of anaerobic bacteria, and the synthesis of ATP by acetolytic methanogenic bacteria; cellulose hydrolysis and ethanol production; acidogenesis; and methanogenesis. Process characterization studies dealt with biodegradation and biotoxicity. The optimization of waste water treatment processes was reviewed in several papers, including ones on the use of powdered activated carbon added to waste water sludge digesters, the use of granular carbon columns, a new process involving the anaerobic attached film expanded bed reactor, and a two-phase anaerobic digestion of glucose solutions supplemented with nutrients. Detailed operation and performance data on selected applications are presented in tabular form for the treatment of refuse/sludge, municipal refuse, cellulose, cattle manure/grass, swine manure, spinach waste, asparagus peels, french bean waste, strawberry slurry, swine manure plus apple pulp, bermuda grass plus nitrogen, and glucose. (Baker-FRC)
W81-03167

MICROBIOLOGY - DETECTION, OCCURRENCE, AND REMOVAL OF VIRUSES,
New Orleans Univ., LA. Dept. of Civil Engineering.
D. Roy.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1839-1846, June, 1980. 66 Ref.

Descriptors: *Viruses, *Water pollution control, *Reviews, Filters, Filtration, *Waste water treatment, Microorganisms, Microbiological studies, Water quality.

Recent literature reports dealing with the areas of detection, occurrence, and removal of viruses from drinking water supplies are cited. In the area of detection methodology, the adsorption-elution method using filters as solid substrate continued to be the most widely used technique for virus detection and concentration in water samples of large volume. To determine the virus quantity in the influent and effluent of a biologic waste water farm, the adsorption-elution method was used with glass powder or glass microfiber filters. The survival of viruses in water and their stability depend on the type of virus, environmental conditions, the extent of the pollution, and whether the virus is free or solid associated. Several studies monitoring the survival of viruses are reviewed. The direct application of sludges and waste water on land may pose an indirect threat to health by contamination of surface and ground waters with viral deposits. Studies have been conducted on numbers of enteric viruses in leachate samples. The adsorbability of different types and strains of human enteroviruses was also investigated. The use of treatment processes to remove viral contamination has employed filter columns using loamy sand, lime flocculation sedimentation treatments, and processes involving activated sludge and alum flocculation. The presence of viruses in shellfish and in the spray of irrigation water was examined. Use of poliovirus as an indicator of viral pollution of waste water has been tested. (Baker-FRC)
W81-03187

GROUNDWATER RESOURCES MANAGEMENT,
Department of Environmental Quality Engineering, Boston, MA. Div. of Water Supply.
For primary bibliographic entry see Field 4B.
W81-03220

WATERSHED MANAGEMENT,
New Haven Water Co., CT.
O. E. Schaefer.
Journal of the New England Water Works Association, Vol 94, No 4, p 281-303, 1980. 2 Tab.

Descriptors: *Watershed management, *Public health, Watershed protection, Water quality, Reservoir management, Monitoring, Land use, Planning, Cooperatives.

New methods and considerations in watershed management are discussed. Watershed protection management in the Northeastern US has traditionally been concerned with the utilization of pure natural waters. Reservoirs and the land immediately next to reservoirs are under the control of the water utility operator. Other lands within the watershed are usually not monitored, and these are the lands which can affect the raw water quality. Evaluating all land use changes within a watershed and taking steps to minimize the adverse impact on water quality means increasing the watershed's management capacities. In the future, watershed protection will involve compilation and maintenance of watershed inventories, watershed-water quality monitoring networks, toxic and hazardous materials handling, emergency preparedness, and seeking cooperation among water utilities and federal and state agencies. Local health departments and planning and zoning commissions all play a role. There must be good organization, communication, and training within water utility organizations. (Small-FRC)
W81-03221

MEDITERRANEAN CLEANUP - NATIONS JOIN FORCES,
For primary bibliographic entry see Field 6E.
W81-03238

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

GUIDE MANUAL FOR PREPARATION OF WATER BALANCES,
Hydrologic Engineering Center, Davis, CA.
R. J. Hayes, K. A. Popko, and W. K. Johnson.
Report, November, 1980. 73 p, 19 Fig, 1 Tab, 54 Ref, Append.

Descriptors: *Water resources development, *Hydrologic budget, *Water supply, *Water use, *Water balance, Planning, Water management, Water conservation, Surface water, Streamflow, Groundwater, Storage.

A water balance is the systematic presentation of data on the supply and use of water within a geographic region for a specific period of time. A water balance can be used for: identification of water supply and use problems; determination of the adequacy of water planning and management data; identification of water conservation opportunities; and assessment of the impact of resource development. Those components selected for a particular water balance need only include those necessary to identify and quantify the significant sources and uses of water within a given region. Supply components include the following: precipitation, streamflow, surface storage, groundwater, imported water, return flow, and saline water. Components necessary to describe the use of water for a water balance may include the following: agricultural use, municipal use, industrial use, water rights, instream flow, and natural depletions. The general relationship between supply and use components can be expressed in water balance equations. The basic form of the water balance

equation will be different for each of the three major supply systems: streamflow, surface storage, and groundwater. When combining actual data for the water balance equations the resultant values will only be approximate, and the two sides of the equation are not likely to be equal. The final results of a water balance analysis can be presented in a variety of ways: tables, charts, graphs, and maps. (Moore-SRC)
W81-02971

THE EPA VALUE ENGINEERING PROGRAM: PART II,
Culp/Wesner/Culp, Cameron Park, CA.
R. B. Williams, and H. Farmer.
Water/Engineering and Management, Vol 128, No 3, p 70-71, 102-103, March, 1981. 3 Fig, 1 Tab.

Descriptors: *Cost analysis, *Waste water facilities, *Construction costs, Management planning, Economic aspects, Construction, Costs.

The Environmental Protection Agency's engineering program provides a technique for the review of the costs of constructing waste water treatment plants prior to construction in order to identify areas where savings may be made. The effectiveness of this program was evaluated. Review of the bid tabulations of several waste water treatment plants and division of the costs within the standard 16 division specification format showed that the major costs for construction of these plants are in the concrete, equipment, and mechanical divisions, which each account for about 20 percent of the total construction costs. Site work, metals, special construction, and electrical divisions together account for almost 30 percent. The composition of the value engineering team should be based on the high cost components, the timing of the workshop in terms of design schedule, and such special construction considerations as architectural or geotechnical requirements. The value engineering reports examined during this study demonstrated that many positive benefits may be achieved from the use of such studies. A major benefit is the exposure of the project designer to the knowledge and experience of other persons who may provide insights to optimization of the project design. It is recommended that value engineering teams should include at least two environmental engineers, since the engineering discipline normally controls about 70 percent of the construction costs of a project. (Carroll-FRC)
W81-03082

HUMAN FACTORS IN DESIGN AND OPERATION OF WATER REUSE FACILITIES,
Army Environmental Hygiene Agency, Edgewood Arsenal, MD.
R. D. Miller, and W. P. Lambert.
Water/Engineering and Management, Vol 128, No 1, p 58, 59, 67, 68, January, 1981. 16 Ref.

Descriptors: *Water reuse, *Human factors engineering, *Planning, *Design criteria, Human psychology, Comprehensive planning, Management planning, Project planning, Waste water renovation.

In order to have attempts to reuse waste water be successful, it is recommended that human factors engineering play a key role in establishing correct interfacing between the plant operator, his machines and his management organization. In order that these interfacings work successfully several recommendations are offered. It is recommended that studies be made to determine effective organization for treatment system management. Continuing studies should be made to determine who the treatment plant operator is and will be including various social, economic, technical, and psychological factors in this type of decision. It is suggested that the graduate sanitary engineering curricula at the master's degree level include the concepts and techniques in human factors engineering so that students will become familiar with the needs to consult in this field and utilize expertise they might otherwise not be aware of. Proper roles for all employees in the plant must be established and clearly understood. All levels of plant management should have easy access to sanitary engineering data and personnel to aid in the solution of problems. (Baker-FRC)
W81-03137

COMMENT ON 'AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL' BY N. BURAS AND P. DARR,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 3C.
W81-03149

SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, NY.
J. R. Stedinger.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1071-1075, June, 1980. 53 Ref.

Descriptors: *Systems analysis, *Water management, *Model studies, *Water quality control, *Reviews, Simulation, Analog models, Computer models, Hydraulic models, Mathematical models, Structural models, Water quality management, Salinity, River basin development.

Various studies conducted in recent years dealing with the systems analysis approach to water management are cited. Studies of water quality models are noted, including models of lakes and watersheds. In the area of water quality management, models are cited dealing with inorganic substances, models for the interaction of pollutants and thermal loads, and models to evaluate the dollar costs, energy costs and river quality impacts of several mixes of point source treatment and flow augmentation using reservoirs. A continuous river flow and salinity simulation planning model is cited, as is a methodology for river basin planning which considers the environmental ramifications of development. A review of water quality and environmental planning in the US is noted. A review of models of non-point-source water pollution from wildland environments was also cited, along with a mathematical model of agriculture and water quality in a specific river basin. Monitoring network design is also discussed in terms of modeling. Mention is also made of waste water treatment models. (Baker-FRC)
W81-03158

6B. Evaluation Process

POTENTIAL EFFECTS OF INCREASED GROUNDWATER PUMPAGE ON BARKA SLOUGH, SAN ANTONIO CREEK VALLEY, SANTA BARBARA COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-02915

SAMPLE DESCRIPTIONS FOR TEST WELLS PENETRATING DEEP AQUIFERS IN DALLAS AND SUMTER COUNTIES, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
J. G. Newton.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 79-1485, October, 1979. 24 p, 1 Fig.

Descriptors: *Aquifers, *Deep wells, *Groundwater availability, *Hydrogeology, *Alabama, Aquifer characteristics, Potential water supply, Planning, Evaluation, Dallas County, Sumter County(AL), Drill cuttings.

Test wells in Dallas and Sumter Counties, Ala., penetrated deep Cretaceous aquifers that are sources of future groundwater withdrawals. The test well in Dallas County was drilled to a depth of 1,460 feet, and the test well in Sumter County was drilled to a depth of 2,311 feet. The deep aquifers in Sumter County are in an area of future residential and industrial development along the Tennessee-Tombigbee Waterway. Descriptions of drill cuttings are given in the report. (USGS)
W81-02927

IMPLICATION OF RECENT USER CHARGE LEGISLATION FOR BARGE TRANSPORTATION OF AGRICULTURAL COMMODITIES,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
J. Binkley, and L. Shabman.
Southern Journal of Agricultural Economics, p 117-123, December, 1980, 3 Fig, 4 Tab, 18 Ref. OWRT-B-082-VA(5).

Descriptors: *User charges, *Inland Waterways, Navigation, Water resources policy, Transportation, *Economic aspects, Agricultural commodities, Barges.

The historical pattern of toll-free inland water transportation in the United States changed in 1978 when Congress voted to impose a fuel tax on inland waterway traffic. The debate over the Inland Waterways Revenue Act of 1978 (P.L. 92-502) was long and torturous. A compromise was reached whereby the effects of waterway user taxes on the diversion of traffic from inland waterways will be evaluated. Based on the results of this evaluation, Congress may choose to reevaluate the imposition of the user charge. The agricultural sector of the economy is likely to be affected by user charges. This study examines the implications of current user charge policy for barge shipments of wheat, corn, and soybeans on the Mississippi River and its major tributaries. A technique of transportation modeling was employed for each commodity. Different regional delineations were used in each model-134 domestic regions in the wheat model, 164 in the corn model, and 161 in the soybean model. Model results for total movements are reported and suggest that current user charge levels have little impact on movements, although loss in farm income is likely.
W81-03009

THE EPA VALUE ENGINEERING PROGRAM. PART I: WHAT IT IS AND WHAT IT DOES,
Culp/Wesner/Culp, Cameron Park, CA.
R. B. Williams, and H. Farmer.
Water/Engineering and Management, Vol 128, No 2, p 49-50, 66, February, 1981. 3 Fig, 7 Tab.

Descriptors: *Construction costs, *Project planning, *Waste water facilities, Economic aspects, Grants, Cost analysis, Evaluation, Performance evaluation, Productivity, Capital.

Value engineering, which is described as a 'systematic and creative approch to identify unnecessarily high costs in a project in order to arrive at a cost savings without sacrificing the reliability or efficiency of the project or increasing operation and maintenance costs,' was introduced into the Environmental Protection Agency's (EPA's) Construction Grant Program on a voluntary basis in 1974. In 1976, EPA instituted a mandatory value engineering program which required all projects with total estimated construction costs of $10 million or greater to have value engineering. An evaluation of 93 value engineering reports on 75 construction grant projects involving waste water treatment works showed that the mandatory program was successful in terms of net capital savings. The results of the value engineering program through 1979 show an average construction costs savings of 5 percent and a net capital savings to value engineering program costs ratio of more than 12 to 1. Evaluation of the productivity of value engineering teams demonstrated that separate value engineering firms are more productive than teams from the design firm. The potential value engineering savings were compared as a percentage of the construction costs. Workshop timing was a critical factor, with earlier workshops offering the greater potential for savings. Also, value engineering teams from the designer's firms had lower levels of potential savings than those from separate design firms. The average acceptance rate for value engineering recommendations was 45 percent. (Carroll-FRC)
W81-03081

THE CASE FOR REGIONAL GROUNDWATER MANAGEMENT,
California Univ., Davis. Dept. of Agricultural Economics.
B. D. Gardner, R. E. Howitt, and C. F. Nuckton.
California Agriculture, Vol 35, No 1/2, p 9-12, January/February, 1981. 2 Tab.

Descriptors: *Water management(Applied), *Regional development, *Groundwater management, Groundwater basins, Aquifers, Groundwater resources, Watersheds(Basins), Aquifer management, Management, Watershed management, Economic impact, Economics, Cost-benefit analysis, San Joaquin Valley, Case studies.

The need for regional management of groundwater basins, operating in the best interests of all the people adjacent to the basin and relying on the use of it, is stressed. The principle of overdrafting of groundwater is explored. It is concluded that overdrafting is not always bad. In some areas overdrafting may prove economically beneficial, even for a long period of time to come. However, at some time a critical point will be reached at which long-term costs of overdraft exceed the short-term benefits in terms of present value. In the San Joaquin Valley, at the present time, groundwater levels and pumping costs dictate that the basins must be defined as to workable size for management, and determinations must be made as to when, and if, overdrafting will become costly to water users. Groundwater management plans should not, however, state that overdrafting should cease or that large amounts of money should be spent on detailed regulation programs for basins that are many years away from reaching optimal steady-state depths. (Baker-FRC)
W81-03132

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC ANALYSIS OF RURAL SLUDGE MANAGEMENT,
University of Central Florida, Orlando. Dept. of Economics.
For primary bibliographic entry see Field 5E.
W81-02933

ECONOMICS,
Clemson Univ., SC.
J. C. Hite, and D. W. Hughes.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1075-1079, June, 1980. 27 Ref.

Descriptors: *Literature review, *Cost allocations, *Economic aspects, *Water quality, Water policy, Water demand, Estimating.

A 1979 literature review on water quality economics is presented. Useful work, both conceptual and empirical, was done in the use of effluent charges and similar devices as alternatives to regulations and standards. Also, a substantial number of articles have been published on problems resulting from agricultural activity, and some new work was published on the estimation of demand for water quality amenities. A significant contribution to the refinement of the effluent charge concept was published by Brill et al.; this demonstrated the use of an effluent charge schedule decreasing the charge per unit of waste as the level of waste discharge increased. Rinaldi et al. examined the use of tax schemes to achieve regional water policy objectives. Nikolai et al. employed financial statement modelling to evaluate the effectiveness of pollution control tax incentives and found them unlikely to be effective over the long term. Polinsky raised questions about even the short-term effectiveness of tax incentive schemes. (Small-FRC)
W81-03159

6D. Water Demand

DENVER'S ECH2ONERGY PROGRAM: A BOON TO HOMEBUYERS, A BOOST FOR HOUSING,
Denver Water Dept. CO.
For primary bibliographic entry see Field 3D.
W81-03073

CHANDLER'S SYSTEMS STAYING ON TOP OF GROWING NEEDS,
Chandler Public Works Dept., AZ.
J. D. Goff, and A. F. Vondrick.
Water/Engineering and Management, Vol 128, No 1, p 42-43, January, 1981.

Descriptors: *Water resources development, Irrigation, Land disposal, Resource development, Water supply, *Water supply development, Waste water disposal, *Water demand, *Arizona, Chandler.

Industrial growth in the area has caused increased demands on the water and waste water systems of Chandler, Arizona. Currently the city contains a 30,000 population, and expects to reach 50,000 residents by the year 1985. One of the plans to meet these growing needs is to apply the city waste water for agricultural purposes. Many large farms use groundwater for irrigation and are served by canals and other irrigation facilities. By directing 20 million gallons of effluent per day using in place facilities of an agricultural operation, water can be more conservatively used. Land application methods would consist of agricultural irrigation and rapid-infiltration systems. Improvements to the already existing water treatment plant will be needed to increase capacity, in addition to the above solutions. The present water treatment system is also to be expanded by the addition of six wells and three storage tanks with a 6-MGD pumping capacity. A telemetry system, now in the preliminary design phase, will be part of the $8 million worth of improvements. (Baker-FRC)
W81-03140

UNIT WATER CONSUMPTION FOR TOWNS IN SOUTH AFRICA,
D. M. Van den Berg.
Civil Engineer of South Africa, Vol 22, No 11, p 353, November, 1980. 1 Fig, 1 Tab.

Descriptors: *Water consumption, *Measurement, Water utilization, *Municipal water, Estimating, Forecasting, Monitoring, Water management(Applied), Water demand, *South Africa.

A unit water consumption study was carried out in South Africa on 104 towns with adequate records of water consumption to estimate the consumption of those towns which had no records of consumption. The estimation procedure calls for multiplying the population of the towns with unknown consumption rates by the unit consumption of towns with similar characteristics, viz., similar climate, size, availability of water, standard of living and efficiency of reticulation. Two sizes of towns were considered: larger towns with a total population greater than 10,000 and smaller towns with a total population of less than 10,000. Standard deviation studies proved that the initial aim of the study was over-optimistic due to wide variations in the results and also because of an insufficient number of towns with known consumption data. Only a generalized pattern of unit consumption could be obtained, and thus the results must be applied with extreme caution. The unit consumption by the white population appears to have reached a ceiling of 140 cubic meters/capita/annum. The steady increase in unit consumption of the non-whites resulted in an average doubling of unit consumption over an eight year period. (Baker-FRC)
W81-03233

6E. Water Law and Institutions

NOTES ON WATER SUPPLY INTERCONNECTIONS, INSTITUTIONAL FACTORS,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt, and H. Sveinbjornsson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202137, Price codes: A04 in paper copy, A01 in microfiche. Report No 22, September, 1980. 49 p, 7 Fig, 4 Tab, 29 Ref, 4 Append. OWRT-A-999-DC(1).

Descriptors: *Institutional constraints, *Water conveyance, *Water management, *Water policy, *Potential water supply, Legal aspects, Water supply, Water supply development, Water resources development, Resources management, Public policy, Resources development, Legal aspects, Riparian rights, Water use, Jurisdiction, State jurisdiction, Decision making, Regional development, Regional planning.

One way to increase water supply reliability in a given area is through the construction of water supply interconnections. Such an approach encompasses engineering, environmental, legal, and management factors; this report was focused mainly on institutional factors. Some comprehensive overview is provided on the potential benefits and problems associated with interconnections, with special reference to the Washington, DC, Metropolitan Area (WMA). A brief description of basic features and historical examples of water supply interconnections is given, and recently proposed interconnections were analyzed. The WMA, due to the number of jurisdictions involved, provides a useful example of the potential problems to be overcome for achieving efficient regional water supply management. Completed water interconnections have been proven effective in providing added reliability and more efficient allocations of existing supplies. Institutional factors offer difficult barriers, however. Potential institutional obstacles to implementation of water interconnection projects were discussed. (Zielinski-IPA)
W81-02906

MINORITY WATER AWARENESS PROGRAM.
Center for Urban Environmental Studies, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-202053, Price codes: A09 in paper copy, A01 in microfiche. Final Report, March, 1981. 185 p, 8 Append. OWRT-C-00222-G(No 0520)(1), 14-34-001-0520.

Descriptors: *Conferences, *Water policy, *Management planning, *Regional planning, *Education, *Decision making, Administrative decisions, Planning, Regional development, Resources development, Environmental policy, Public policy, Judicial decisions, Policy making, Political aspects, Federal jurisdiction, Governmental interrelations, Legal aspects, Water use, Symposium, *Minority leaders.

The Minority Water Awareness Program (MWAP) was created to bring minority (Black, Hispanic and Indian) leaders in the Southwest into the mainstream relative to water policy-making and implementation, since they are in a unique position to articulate priorities of water awareness to their legislative, governmental and constituent communities. The MWAP consisted of a two-day forum in Phoenix (January 29-31, 1981) having general sessions with major speakers, as well as six concurrent workshops designed to provide useful essential information to participants. This report delineates the MWAP objectives, strategy, and the preparation, implementation and evaluation of the two-day conference. Based on the accomplishments of this Program, it was recommended that other national areas need to be addressed regarding impacts on minority/low-income communities. A problem encountered in locating minority decision-makers in the water area was perceived as reflective of the lack of minority involvement in water. Recommendations for reduction of this problem were suggested which need heeding if water policy is to be reflective of all elements of society. (Zielinski-IPA)
W81-02910

WATER LAW - REFUSING IRRIGATION WASTE WATER ON DIFFERENT LANDS: A WARNING TO GET A NEW PERMIT,
R. A. Thompson.
Land and Water Law Review, Vol 16, No 1, p 71-83, 1981. 1 Fig.

Descriptors: *Water rights, *Legal aspects, Water use, Property rights, *Water reuse, Irrigation, Waste water collection, *Irrigation permits, Permits, Irrigation-return flow, Irrigation operation.

The legal case cited herein deals with the use of irrigation waste water which had been allowed to collect in a borrow pit at the edge of one farmer's fields. This same farmer had, for a 15 yr period, reused this water by diverting its flow from the borrow pit to an additional field of his across a state highway. A second farmer appealed to the district court for a permit to appropriate the waste water in the borrow pit for use on his land, which was also adjacent to the borrow pit. The court upheld the second farmer's permit, and the original user of the waste water was the loser as a result of his failure to secure a permit to appropriate this waste water himself. (Baker-FRC)
W81-03102

ENVIRONMENTAL ISSUES: STILL CLOUDED IN UNCERTAINTY,
For primary bibliographic entry see Field 5C.
W81-03107

FEDERAL WATER POLLUTION LAWS AND MINING--A SUMMARY,
Holland and Hart, Denver, CO.
J. R. Walpole.
Mining Engineering, Vol 33, No 1, p 74-80, January, 1981. 61 Ref.

Descriptors: *Legal aspects, *Mining, *Water pollution control, Federal Water Pollution Control Act, Safe Drinking Water Act, Solid Waste Disposal Act, Surface Mining Control and Reclamation Act, Legislation, Regulation, Waste disposal, Potable water, Coal mines, *Water law.

Several federal laws concerning water pollution as related to the mining industry are summarized. The Federal Water Pollution Control Act, whose objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters, regulates discharges from point sources and non-point sources and requires numerical restrictions on the nature and quantity of pollutants discharged in a waste stream. Best practicable control technology, best conventional pollutant control technology, best available technology economically achievable, and best management practices are defined and discussed. The Safe Drinking Water Act of 1974 regulates the development and implementation of national drinking water regulations governing public water supply systems and underground fluid injection activities. The Solid Waste Disposal Act, amended 1976, is designed to promote the protection of health and the environment and to conserve valuable mineral and energy resources. Hazardous waste management, solid waste management, and mining wastes are discussed. The Surface Mining Control and Reclamation Act, 1977, establishes a nationwide program to protect society and the environment from the adverse effects of coal mining. (Cassar-FRC)
W81-03108

COMMENTS TO THE U.S. ARMY CORPS OF ENGINEERS REGARDING PROPOSED REGULATIONS ON IMPLEMENTING SECTION 404 OF THE CLEAN WATER ACT: A POSITION OF THE SOCIETY OF AMERICAN FORESTERS.
For primary bibliographic entry see Field 4A.
W81-03134

THE LEGAL IMPLICATIONS OF GROUND WATER HEAT PUMP USE,
National Water Well Association, Worthington, OH.
J. Miller.
Water Well Journal, Vol 34, No 7, p 66-73, July, 1980. 1 Tab.

Descriptors: *Regulations, *Thermal discharges, *Groundwater pollution, Effluents, Disposal wells, Underground waste disposal, Legal aspects, *Heat pumps, State jurisdiction, Well permits.

The use of ground water source heat pumps may meet with legal problems involving water use and water quality control. This alternative energy source could be impeded by federal, state, and local laws. A ground water source heat pump for residential heating requires a well that can provide up to 15 gallons of water per minute. In some areas well drilling requires a permit. The real problem is caused by the fact that operation of the heat pump requires the disposal of up to .15 gpm of slightly heated or cooled water. Whether this water is discharged to an aquifer recharge well, to a surface water body, to a leachfield, or to a sewer, each of these disposal methods may be subject to regulation. Federal regulations will not have much impact on the situation, but local and state controls must be considered. A table is presented which summarizes ground water heat pump use and disposal regulations by state. It includes any water use permits that may be required, and any regulations dealing with disposal to: recharge well, surface water, land, septic tank, and sewer. (Small-FRC)
W81-03148

LAW,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
W. E. Cox, and W. R. Walker.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 52, No 6, p 1079-1083, June, 1980. 45 Ref.

Descriptors: *Water law, *Literature review, *Water quality, Water pollution control, Nonpoint pollution sources, Waste water treatment.

A literature review is presented on 1979 articles on water quality law. Articles were published which provided general overviews of pollution control programs, and more specific articles have dealt with energy related contamination problems, management of hazardous substances, control of nonpoint sources of pollution, and groundwater quality protection. Overviews included analyses of the Clean Water Act (Kalur), enforcement under the act (Olds), and the municipal waste water treatment portions of the act (James, Milliken and Trumbly). A discussion of the conflicts between water quality and energy production goals (Brown et al.), control of oil pollution (Wittig, Puglisi, Gibbs and Teeter, and Muehlenweg), and off-shore energy development (Woodson et al.) were among topics receiving attention in the literature. Control of hazardous substances was given considerable attention, including an entire issue of EPA Journal devoted to the subject. (Small-FRC)
W81-03160

MEDITERRANEAN CLEANUP - NATIONS JOIN FORCES,
C. Dalpra.
Journal of the Water Pollution Control Federation, Vol 53, No 2, p 149-151, February, 1981.

Descriptors: *Water pollution prevention, *Mediterranean Sea, *Water quality control, Monitoring, Pesticides, Heavy metals, Fate of pollutants, Planning, Management planning, Water pollution sources, Water pollution control, Oil wastes, Research priorities, Path of pollutants, International waters, Foreign projects.

In 1975, the Mediterranean Action Plan, an international effort to develop long-term goals for environmental action, was approved to help solve the pollution problems of the Mediterranean Sea. The plan contained one general and two specific protocols involving restrictions on dumping into the sea by ships and aircraft, and special measures for combating pollution by oil and other harmful substances. The Convention for the Protection of the Mediterranean Sea and the three protocols were adopted in 1976. The biggest source of pollution on the Mediterranean was from the land. A legal agreement was drafted and scientific research conducted to assess the problem. In 1975, the Mediterranean countries approved the Mediterranean Pollution Monitoring and Research Program (MED POL). MED POL conducted pilot projects dealing with baseline studies on petrochemicals, heavy metals, pesticides, pollution transport, and the sanitation of recreational and fishing waters. Integrated planning and management has been facilitated by the UNEP. Preliminary budget estimates for 1981 programs of the MED POL plan were set at $4.5 million. (Geiger-FRC)
W81-03238

6G. Ecologic Impact Of Water Development

TEXAS BARRIER ISLANDS REGION ECOLOGICAL CHARACTERIZATION: A SOCIO-ECONOMIC STUDY, VOLUME 1: SYNTHESIS PAPERS,
Willdan Associates, Phoenix, AZ.
E. B. Liebow, K. S. Butler, T. R. Plaut, V. L. Arnold, and G. H. Ford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137804, Price codes: A13 in paper copy, A01 in microfiche. Fish and Wildlife Service Report FWS/OBS-80/19, August, 1980. 277 p, 15 Fig, 56 Tab, 399 Ref. FWS 14-16-0009-79-103.

Descriptors: *Ecosystems, *Coastal zone management, *Resources management, *Social aspects, Planning, Oil industry, Tourism, Recreation, Commercial fishing, Industrial development, Transportation, Agriculture, Human population, Economics, Environmental effects, *Texas Barrier Islands Region.

Information from existing sources concerning the natural, physical, and social components of the ecosystems within the Texas Barrier Islands Region has been collected as an aid to coastal resource planning and management. Source documents have been combined into synthesis papers for each of six topics: oil and gas production; recreation/tourism industry; commerical fishing industry; industrial and residential development; transportation systems; and agricultural production. For each topic the historical development and growth patterns are surveyed, the economic value to the state and environmental impacts are described, and possible future developments and areas where further research is required are suggested. The socioeconomic components of the ecosystems have received special attention because of the extensive oil and gas activities and their impact on the area. Each paper provides a brief overview of a range of topics, in order to describe general trends and region-wide factors influencing the relationships between complex growth processes and the availability of natural resources. (Brambley-SRC)
W81-02972

TEXAS BARRIER ISLANDS REGION ECOLOGICAL CHARACTERIZATION: A SOCIO-ECONOMIC STUDY, VOLUME 2: DATA APPENDIX,
Willdan Associates, Phoenix, AZ.
E. B. Liebow, K. S. Butler, T. R. Plaut, V. L. Arnold, and G. H. Ford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137812, Price codes: A24 in paper copy, A01 in microfiche. Fish and Wildlife Service Report FWS/OBS-80/20, August, 1980. 572 p, 39 Fig, 202 Tab, 190 Ref. FWS 14-16-009-79-103.

Descriptors: *Ecosystems, *Coastal zone management, *Resources management, *Social aspects, *Data acquisition, Human population, Employment, Agriculture, Oil industry, Mineral industry, Transportation, Tourism, Recreation, Industrial development, Fish management, Wildlife management, Utilities, Land management, *Texas Barrier Islands Region.

This volume presents the socioeconomic data upon which the synthesis papers of the previous volume on the Texas Barrier Islands Region were based. The figures and tables are organized into the following categories: population; employment and income characteristics; agricultural production; mineral production and oil and gas activites; fish and wildlife production; transportation; recreation and tourism industries; public utilities; industrial

and residential development and point source discharge; and land practices and management. The bases for defining the study's data categories and the relative analytical emphasis that each data category received were the uses to which the data were put. Criteria used in evaluating the reliability and consistency of the data base include the comparability of data sources in generating a time series, geographic relevance to the study area and its planning regions, and appropriateness of data source methodology. A critical objective to be fulfilled as a result of the data collection and evaluation task was to identify problems with data gaps and inconsistencies, and to recommend ways to resolve them. (Brambley-SRC)
W81-02973

STOCHASTIC SIMULATION OF DAILY PRECIPITATION, TEMPERATURE, AND SOLAR RADIATION,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
For primary bibliographic entry see Field 2B.
W81-03063

EVOLUTION OF MANAGEMENT POLICY AND RESEARCH IN THE NATIONAL PARKS,
Michigan Technological Univ., Houghton. Dept. of Biological Sciences.
J. R. Stottlemyer.
Journal of Forestry, Vol 79, No 1, p 16-20, January, 1981. 4 Fig, 12 Ref.

Descriptors: *National parks, *Management, *Water policy, Research and development, *Ecology, Wildlife management, Grand Canyon National Park, Everglades National Park, Legislation, Legal aspects, National Environmental Policy Act, Glen Canyon Dam, Dams.

This paper traces the changes in management policies for National Parks since their establishment in 1872. A paucity of research and a lack of overall policy has made park management inconsistent in the past. Enactment of legislation such as the National Environmental Policy Act in 1969 has helped to make policies more uniform. The present aim in park management is to return the ecosystems to the condition prevailing before European settlers arrived. Many ecological problems originate outside park boundaries. An example of this is in the Everglades National Park, Florida, where national park research prevented the construction of the Miami Jetport in 1971 and authorized the Big Cypress Preserve in 1975 to protect the park's watershed. A 2-year ecological survey, begun in 1973, showed that the 15-year old Glen Canyon Dam on the Colorado River upstream from Grand Canyon National Park will have effects far greater than present visitor use, with possibly 13 species of fish being lost. In this case, no acceptable solution seems possible. The author suggests that management policies should be based on good research and that there is a need for considerable upgrading in quality and quantity of scientific research in the national parks. (Cassar-FRC)
W81-03120

SHORELINES MANAGEMENT IN FRANCE: A COMMENT ON RECENT REGULATIONS,
Ottawa Univ. (Ontario). Dept. of Geography.
P. Harrison, and W. R. D. Sewell.
Coastal Zone Management Journal, Vol 8, No 3, p 257-262, 1980. 6 Ref.

Descriptors: *Shore protection, Resources management, *Coastal waters, Regulations, Water regulations, Planning, Administrative regulations, *France, Policy making, *Lake shores, Administrative decisions, Legal aspects, Coastal zone management.

Recent activities in France concerning shoreline water management are discussed. These advancements revolve around the principles of urban and regional planning as they apply to coastal areas. Specific reference is made to a decree passed by the French government in 1979 spelling out the national concern for shoreline development as well as stating the controls and procedures to be used along all marine and most lake shorelines. The content of the decree and the possible implications of the decree are discussed. The decree was hoped to stop the haphazard urbanization of shorelines and preserve natural environment, and promote the development of marine-oriented activities. The second major goal for the decree was to adapt and mold installations to the nature of a particular shoreline. The third purpose was to keep a close control on the architectural quality of particular structures. (Baker-FRC)
W81-03198

7. RESOURCES DATA

7B. Data Acquisition

FEASIBILITY OF USING AN ACOUSTIC VELOCITY METER TO MEASURE FLOW IN THE CHIPPS ISLAND CHANNEL, SUISUN BAY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
S. H. Hoffard.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-697, August, 1980. 28 p, 15 Fig, 3 Tab, 3 Ref.

Descriptors: *Streamflow, Bays, *Deltas, *Outflow, Channel flow, *California, Hydrologic budget, Estuaries, Current meters, Water measurement, Discharge measurement, Velocity, Acoustics, Stream gages, Suisun Bay, Chipps Island Channel, Sacramento-San Joaquin Delta, Acoustic velocity meters.

Tests were conducted in 1978 to determine the feasibility of using an acoustic velocity meter to measure the Sacramento-San Joaquin Delta outflow in the Chipps Island Channel, Suisun Bay, Calif. Three parts of transducers with frequencies of 100, 40, and 24 kilohertz were installed on a cross-channel test path and operated at three elevations, 15.5, 8.0, and 4.0 feet below mean lower low water, to test signal transmission at varying depths. Transmission was most reliable at the lowest depth, and the 24-kilohertz transducers at the 7-millivolt threshold of signal strength met the study's criterion of no persistent signal loss of more than one hour's duration in any phase of the tidal cycle. Signal strength was statistically correlated with the environmental factors of wind velocity, wind direction, solar insolation, electrical conductivity, water temperature, water velocity, stage, rate of change in stage, and the acceleration of the rate of change in stage. All correlations were weak. Signal strength is apparently a function of the interaction of several environmental factors. A 32-day test to observe if aquatic growth on the transducers would affect signal transmission showed no reduction in signal strength. Suspended-sediment samples indicated that both the size and concentration of particles are greater than presumed in earlier studies. According to the results of this study, chances are good for reliable transmission of acoustic velocity meter signals. Usually some signals were much stronger than the average 20-second signal strength at 15-minute intervals used for correlation and the frequency analysis. Superior equipment is now being developed specifically for the Chipps Island site to transmit signals several times stronger than the signals analyzed in these tests. (USGS)
W81-02921

SAMPLERS AND SAMPLING PROCEDURES FOR HAZARDOUS WASTE STREAMS,
California Dept. of Health Services, Berkeley.
E. R. deVera, B. P. Simmons, R. D. Stephens, and D. L. Storm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-135353, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-80-018, January, 1980. 77 p, 19 Fig, 14 Tab, 20 Ref, 5 Append. R804692010

Descriptors: *Industrial wastes, *Hazardous materials, *Sampling, Sample preservation, Liquid wastes, Solid wastes, Sample preparation, Safety, Testing procedures, Soil contamination.

Industrial waste predominantly occurs in large volumes, so that representative samples must be obtained for testing. Simple but effective sampling equipment and procedures were developed for collecting, handling, storing, and recording samples of hazardous wastes. A variety of sampling devices exist which are designed for use with hazardous wastes. Soil and solid waste samplers are described and the development of a composite liquid waste sampler, the Coliwasa, is detailed. The sampler is effective for liquid and semi-liquid wastes in a variety of containers, tanks and ponds. Procedures are described for the development of a sampling plan, sample handling, safety precautions, proper recordkeeping and chain of custody, and sample containment, preservation and transport. Limitations and potential sources of error exist in the sampling equipment and the procedures; correction factors are presented. The equipment was designed to have the widest possible applicability in the sampling of various types of hazardous wastes. User verification on a large scale is required to confirm the applicability and develop standardized sampling methods. (Brambley-SRC)
W81-02946

FREE, PROTEINACEOUS, AND HUMIC-BOUND AMINO ACIDS IN RIVER WATER CONTAINING HIGH CONCENTRATIONS OF AQUATIC HUMUS,
Portland State Univ., OR. Dept. of Chemistry.
C. R. Lytle, and E. M. Perdue.
Environmental Science and Technology, Vol 15, No 2, p 224-228, February, 1981. 6 Fig, 1 Tab, 27 Ref.

Descriptors: *Amino acids, *Williamson River, *Oregon, Resins, Rivers, Marshes, Analytical methods, *Humic acids, Decomposing organic matter.

The proteinaceous portion of dissolved organic matter (DOM) in the Williamson River, Oregon, is investigated. The first part of the study presents results of a 2 yr monthly survey of total amino acids in the river and its principal tributaries. The second part describes a fractionation study of the amino acids, utilizing a macroreticular resin. Fifteen major amino acids were separated. The two yr averages for humic carbon closely follow the amino acid averages. The overall study indicated that the Klamath Marsh had a very significant effect on the amount of amino acids and humic carbon in the river. Averages over the 2 yr were about 1 micromolar in the river before the marsh, whereas 5 micromolar levels were found in the marsh itself and an average of 8 micromolar in the river directly after the marsh. The novel use of the XAD-7 macroreticular resin made it possible to separate dissolved amino acids into humic associated and non-humic associated fractions. At least 96% of the dissolved amino acids were associated with aquatic humus, and amino acid carbon comprised about 1% of the humic carbon. It is suggested that the amino acids are associated with humic substances in soil and are carried into the stream by surface runoff. (Baker-FRC)
W81-03099

THE SIMULTANEOUS ANALYSIS OF TOTAL NITROGEN AND TOTAL PHOSPHORUS IN NATURAL WATERS,
National Board of Fisheries, Goeteborg (Sweden). Inst. of Hydrographic Research.
J. C. Valderrama.
Marine Chemistry, Vol 10, No 2, p 109-122, 1981. 2 Fig, 8 Tab, 7 Ref.

Descriptors: *Nitrogen, *Phosphorus, *Analytical techniques, Water analysis, Spectrometry, Natural waters.

Various tests were run to evaluate the persulfate oxidation method suggested for the simultaneous determination of total nitrogen and total phosphorus in water. The method exhibits very good reli-

ability and precision. An alkaline medium is used to allow the nitrogen compounds to become oxidized. Phosphorus compounds are oxidized on an acidified sample. In the simultaneous oxidation the reaction begins at pH 9.7 and ends at pH 5-6. In seawater samples no precipitate is formed when the oxidation reagent is added. At elevated temperatures a precipitate is formed which almost dissolves as oxidation proceeds. After oxidation the remaining small amount dissolves on swirling. The free chlorine formed in seawater samples is reduced by adding ascorbic acid before the molybdate reagent. The absorbances of the samples were measured using a spectrophotometer. (Baker-FRC)
W81-03103

ECONOMIC IMPLICATIONS OF A MANAGEMENT-ORIENTED REMOTE SENSING PROGRAM,
Maryland Univ., Frostburg. Appalachian Environmental Lab.
D. M. Harman, D. B. Fuller, R. Tsuchigane, and K. B. Fuller.
Coastal Zone Management Journal, Vol 8, No 2, p 105-122, 1980. 6 Tab, 3 Ref.

Descriptors: *Remote sensing, *Performance evaluation, *Costs, Economic aspects, Optimization, Satellite technology, Runoff, Drainage patterns, Channeling, Dredging, Outfall sewers.

An economic study to gage the cost effectiveness of remote sensing was conducted by the Chesapeake Bay Ecological Program. The study also sought to determine the potential increase in managerial efficiency due to remote sensing. Data were obtained from major users, private remote sensing firms and from staff personnel of the NASA Wallops Flight Center. Remote sensing projects included were both water-related and non-water-related; water-related aspects monitored included drainage and runoff patterns from land areas, effects of channel dredging, and suitable sites for a sewage outfall. The attributes of remote sensing found to make it economically more attractive were accuracy, uniformity, completeness, reliability, research and development capacity, cost savings, and managerial effectiveness. The total contribution of NASA to eight of the users was $113,956 in cost savings, 59 man-months in time savings, plus significant percentage gains in managerial efficiency. In general, cost savings realized with remote sensing were 50%. Managerial efficiency was measured by the difference in achievement of objectives by remote sensing and by conventional methods. In seven of the nine projects studied, users stated that remote sensing increased managerial efficiency from 15 to 55%. (Small-FRC)
W81-03195

PUMPING TEST ANALYSES FOR LOW YIELD FORMATIONS,
UOP Inc., St. Paul, MN. Johnson Div.
D. C. Schafer.
Johnson Drillers Journal, Vol 52, No 6, p 2-4, November/December, 1980. 1 Fig, 1 Tab.

Descriptors: *Pumping tests, *Aquifer testing, *Transmissivity, Flow measurement, *Water yield, Water wells, Wells, Drawdown, Hydrology, Groundwater.

Conventional pumping test analysis using the standard time drawdown graph does not work effectively in low yielding aquifers. A better approach is to pump a substantial portion of the casing empty (quickly, using compressed air), shut off the pump, and measure water levels as they recover, noting the drawdown to the nearest hundredth of a foot and time to the nearest second. An equation is used to calculate transmissivity. (Cassar-FRC)
W81-03229

7C. Evaluation, Processing and Publication

UNITED STATES GEOLOGICAL SURVEY YEARBOOK, FISCAL YEAR 1980.
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price: $6.00. 1980. 137 p.

Descriptors: *Reviews, Data collections, *Natural resources, Water quality, Energy, Mapping, Geological surveys, Volcanoes, Landslides, Mineralogy, Land management, Oil industry, Administration, Cost allocation, Budgeting, *U.S. Geological Survey activities.

The fiscal year 1980 Yearbook summarizes the activities of the U.S. Geological Survey in response to its scientific and regulatory missions and its responsibility for exploration of the National Petroleum Reserve in Alaska. The main sections of this Yearbook are: (1) The Year in Review; a brief overview of the significant events of the Geological Survey during fiscal year 1980; (2) Perspectives; essays focusing on specific events (rather than scientific topics) and programs involving multi-Division participation; (3) Missions, Organization, and Budget; a description of the Geological Survey's major duties and assignments and of the organizational structure that supports its missions; (4) Division Chapters; a description of the significant accomplishments (rather than a comprehensive program by program discussion) of each of the eight operating Divisions and Offices; and (5) Appendices; provide supplementary information regarding key personnel, cooperators, and selected summary budgetary tables and an index. (USGS)
W81-02914

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF SOUTHEASTERN MASSACHUSETTS, NORTHWEST SHORE OF BUZZARDS BAY,
Geological Survey, Boston, MA. Water Resources Div.
J. R. Williams, R. E. Willey, and G. D. Tasker.
Massachusetts Hydrologic-Data Report No 20, 1980. 30 p, 7 Tab, 23 Ref, 1 Plate.

Descriptors: *Groundwater, *Surface water, *Water quality, *Massachusetts, Hydrologic data, Coastal streams, River basins, Streamflow, Discharge measurement, Specific conductivity, Temperature, Wells, Well data, Drillers logs, Stratigraphy, Water table, Water yield, Water supply, Chemical analysis, Water resources development, Southern Massachusetts.

The coastal drainage basins of southeastern Massachusetts on the northwest shore of Buzzards Bay, are those of Sippican River which empties into Weweantic River estuary, Aucoot Brook, Mattapoisett River, Acushnet River, and Paskamansett River which empties into Slocum's River estuary. These basins are bounded on the east by the Weweantic River basin, on the north by the Taunton River basin, and on the west by the basin of East Branch Westport River. This report presents, in tabular form, selected records of wells, test wells, boring, and important springs; measurements of stream discharge, specific conductance, and temperature at partial-record stations; chemical analyses of groundwater and surface water; and a summary of municipal water sources and additional sources available. The data were collected during a study of the drainage basins from 1969 to 1971. (USGS)
W81-02917

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF NORTHEASTERN MASSACHUSETTS, FROM CASTLE NECK RIVER, IPSWICH, TO MYSTIC RIVER, BOSTON,
Geological Survey, Boston, MA. Water Resources Div.
D. F. Delaney, and F. B. Gay.
Massachusetts Hydrologic-Data Report No 21, 1980. 40 p, 5 Tab, 21 Ref, 1 Plate.

Descriptors: *Groundwater, *Water quality, *Massachusetts, *Wells, Test wells, Well data, Coastal streams, Drillers logs, Water table, Hydrologic data, River basins, Chemical analysis, Water resources development, Data collections, *Northeastern Massachusetts.

The coastal drainage basins northwest of Boston, Mass., and south of the Ipswich River basin drain about 230 square miles. Principal streams draining the area are the Annisquam, Castle Neck, Danvers, Essex, Mystic, and Saugus Rivers which flow into the Ipswich and Massachusetts Bays of the Atlantic Ocean. Information in this report includes well, test well, and boring data; chemical analyses of groundwater compiled from 1972 to 1974; and a list of publications containing groundwater level records. (USGS)
W81-02918

HYDROLOGIC SETTING OF WETLANDS IN THE COTTONWOOD LAKE AREA, STUTSMAN COUNTY, NORTH DAKOTA,
Geological Survey, Denver, CO. Water Resources Div.
T. C. Winter, and M. R. Carr.
Geological Survey Water-Resources Investigations 80-99, 1980. 42 p, 17 Fig, 3 Tab, 29 Ref.

Descriptors: *Hydrology, *Wetlands, Lakes, *Hydrologic data, Geology, Atmospheric water, Precipitation, Evaporation, Model studies, Simulation analysis, Data collections, Groundwater movement, Groundwater recharge, Seepage, Surface-groundwater relations, Wells, Water level, Water table, *North Dakota, Cottonwood Lake area, Stutsman County.

Because of growing interest in the role of lakes and wetlands in the hydrology of the prairie environment, a group of wetlands in the Cottonwood Lake area, Stutsman County, N. Dak., are being instrumented for long-term hydrologic studies. The study site is on a regional topographic high near the eastern edge of the Missouri Coteau and is underlain by more than 400 feet of glacial drift, largely silty, clayey till. Long-term climatic data indicate the study area is in a water deficient area--mean annual evaporation exceeds mean annual precipitation by about 18 inches. Different methodologies are being used to compare measurements and estimates of each hydrologic component interacting with the lakes and wetlands. For example, for a 3-month period in 1979, estimates of precipitation for the study site using data collected at National Weather Service stations differed from that measured by a recording gage at the study site by several tenths of an inch for 14-day totals and differed by more than half an inch for individual storms. Numerical simulation analysis of regional groundwater flow systems shows the study site is situated in a regional recharge area, but local groundwater flow systems can discharge to lakes and wetlands within the recharge area. Instrumentation at the study site shows a complex interrelation of wetlands and groundwater. Based on data for 1979 only, some wetlands appear to recharge groundwater, some wetlands are flow-through types where groundwater enters one side and surface water seeps to groundwater on the other side, and some wetlands are discharge points for groundwater. Further, these interrelations vary throughout the year. (USGS)
W81-02919

WATER-QUALITY DATA FROM TAYLOR CREEK DRAINAGE BASIN, EL DORADO COUNTY, CALIFORNIA, JULY 1975 THROUGH OCTOBER 1976,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. E. Templin, D. B. Green, and R. F. Ferreira.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1178, December, 1980. 95 p, 2 Fig, 16 Tab, 30 Ref.

Descriptors: *Water quality, *Data collections, *Watersheds, Lakes, Streams, Biological properties, Nutrients, Chemical properties, Primary pro-

ductivity, Sampling, *Baseline studies, Sites, Evaluation, *California, Taylor Creek, El Dorado County.

Data were collected from July 1975 through October 1976 to establish benchmark water-quality conditions in the Taylor Creek drainage basin in California. The Taylor Creek drainage basin is a high-altitude system of lakes and streams which forms one of the tributaries to Lake Tahoe in the Sierra Nevada of California and Nevada. Sampling sites were distributed between the upper and lower reaches of the basin. Streamflow and water-quality data were collected at 13 stream sites. Water-quality data and depth profiles were collected at six lake sites. The reconnaissance included measurement and evaluation of the following selected characteristics: major chemicals, nutrients, fecal coliform bacteria, phytoplankton, periphytic algae, benthic macroinvertebrates, primary productivity, and stream community diversity. (USGS)
W81-02920

HYDROGEOLOGIC DATA FOR SELECTED COAL AREAS, EAST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. S. Roberts.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $10.50 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-329 (WRI), April, 1980. 63 p, 2 Fig, 4 Tab, 1 Plate.

Descriptors: *Hydrologic data, *Geology, *Groundwater hydrology, *Coal mining potential, Data collection, Wells, Water level, Well data, Lithologic logs, Water quality, Chemical analysis, *Montana, Resources development.

Hydrogeologic data were collected in selected coal areas of east-central Montana to provide a basis for evaluating the effects of future coal development on the groundwater resources. Inventory records for 916 domestic, stock, public supply, commercial, and test wells are tabulated in the report; the data were collected principally from 1975 through 1976. The locations of the wells are shown on a map at a scale of 1:250,000. Lithologic logs are also included for 149 wells. Chemical analyses of water samples from selected wells consist of 167 samples analyzed for major cations and anions and 24 samples analyzed for miscellaneous constituents. (USGS)
W81-02922

HYDROLOGY AND WATER QUALITY OF THE COPPER-NICKEL STUDY REGION, NORTHEASTERN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
D. I. Siegel, and D. W. Ericson.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-739 (WRI), 1980. 87 p, 38 Fig, 22 Tab, 13 Ref, 1 Plate.

Descriptors: *Hydrologic data, *Water quality, *Copper, *Nickel, *Baseline studies, Groundwater, Groundwater movement, Aquifer characteristics, Wells, Pumping, Drawdown, Transmissivity, Surface water, Streamflow, Flow characteristics, Hydrologic budget, Water use, Chemical analysis, *Minnesota, Northeastern Minnesota, Copper-Nickel study region, Potential mining effects, Resources development.

Data were collected on the hydrology of the Copper-Nickel study region to identify the location and nature of groundwater resources, determine the flow characteristics and general quality of the major streams, and determine the potential effects of mining copper and nickel on the hydrologic stream. Groundwater generally occurs in local flow systems within surficial deposits and in fractures in the upper few hundred feet of bedrock. Yields commonly range from 1 to 5 gallons per minute from wells in surficial materials and bedrock, but can be as much as 1,000 gallons per minute from wells in the sand and gravel aquifer underlying the Embarrass River valley. Groundwater generally is calcium-magnesium bicarbonate types. Over a mineralized zone, groundwater has concentrations of copper and nickel greater than 5 micrograms per liter. The average annual runoff from streams in the study area is about 10 inches. About 60% of the annual runoff occurs during snowmelt in spring. Flood peaks are reduced in streams that have surface storage available in on-channel lakes and wetlands. Specific conductance in streams can exceed 250 micromhos per centimeter at 25 Celsius where mine dewatering supplements natural discharge. Estimated groundwater discharge to projected copper-nickel mines ranges from less than 25 to about 2,000 gallons per minute. The introduction of trace metals from future mining activities to the groundwater system can be reduced if tailings basins and stockpiles are located on material which has low permeability, such as till, peat, or bedrock. (USGS)
W81-02925

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1979--VOLUME 1. COLORADO RIVER BASIN, SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-181448, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CA-79-1, January, 1981. 599 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *California, Colorado River basin, Southern Great Basin, *Pacific slope basins, *Southern California.

Volume 1 of water resources data for the 1979 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells in southern California. This report contains discharge records for 202 gaging stations, stage and contents for 26 lakes and reservoirs, water quality got 68 stations, and water levels for 150 observation wells. Also included are 16 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (USGS)
W81-02928

CHANGES IN QUALITY OF GROUNDWATER IN THE LINCOLN AREA, MONTANA, 1974-79,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-02976

HYDROLOGIC DATA FOR URBAN STUDIES IN THE AUSTIN, TEXAS METROPOLITAN AREA, 1978,
Geological Survey, Austin, TX. Water Resources Div.
R. M. Slade, Jr., M. E. Dorsey, J. D. Gordon, and R. N. Mitchell.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $29.75 in paper copy, $3.50 in microfiche. Geological Survey Open File Report 80-728, July, 1980. 229 p, 15 Fig, 11 Tab, 5 Ref.

Descriptors: Hydrologic data, *Urban hydrology, *Urban runoff, *Rainfall-runoff relationships, *Storm runoff, Streamflow, Flow rates, Colorado River, Watersheds(Basins), Groundwater resources, Water quality, Flood profiles, Peak discharge, Watershed management, Data collections, Texas, *Austin.

This report contains rainfall and runoff data collected during the 1978 water year for the Austin, Texas metropolitan area. In 1975, the program was expanded to include the collection of water-quality data. In 1978, the program was expanded to include a groundwater resources study of the south Austin metropolitan area in the Balcones fault zone. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. The major streams in the study area are the Colorado River, Onion Creek, Barton Creek, Walnut Creek, Bull Creek, Boggy Creek, Shoal Creek, and Waller Creek. Detailed rainfall-runoff computations are presented for five storm periods during the 1978 water year. Water-quality data for sites in the Austin metropolitan area are also given in this report. (USGS)
W81-02977

HYDROLOGIC DATA FOR URBAN STUDIES IN THE HOUSTON, TEXAS, METROPOLITAN AREA, 1978,
Geological Survey, Houston, TX. Water Resources Div.
J. S. Hutchison, and J. F. Weigel.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $23.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1184, October, 1980. 184 p, 14 Fig, 12 Tab, 6 Ref.

Descriptors: *Urban hydrology, *Rainfall-runoff relationships, *Storm runoff, *Urban runoff, *Water quality, Hydrologic data, Small watersheds, Streamflow, Flow rates, Peak discharge, Flood profiles, Watershed management, Texas, *Houston.

This report contains rainfall and runoff data collected during the 1978 water year for drainage basins in the Houston, Tex., metropolitan area. The information will be useful in determining the extent to which progressive urbanization will affect the yield and mode of occurrence of storm runoff. Rainfall-runoff computations are presented for three storm periods during the 1978 water year. (USGS)
W81-02978

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1978,
Geological Survey, Austin, TX. Water Resources Div.
E. R. Carrillo.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $2.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-744, April, 1980. 20 p, 1 Fig, 5 Ref.

Descriptors: Hydrologic data, *Streamflow, Runoff, *Reservoir storage, *Water quality, Small watersheds, Texas, Drainage area, Gaging stations, Inflow, Discharge(Water), Rainfall, Chemical analysis, *Mountain Creek, *Trinity River basin.

This report is a compilation of runoff and storage data collected during the 1978 water year in the Mountain Creek basin. Mountain Creek drains the northeast corner of Johnson County, the northwest corner of Ellis County, the southeast corner of Tarrant County, and part of the southwest corner of Dallas County, Tex. The basin is 30 miles long and averages 10 miles in width. The total drainage area at the mouth is 304 square miles. Basin outflow for the 1978 water year was 3,520 acre-feet which is only 5% of the 18-year (1960-78) average of 76,070 acre-feet. Storage in Mountain Creek Lake showed a net loss of 890 acre-feet during the water year. Rainfall over the study area for the 1978 water year was about 24 inches, which is about 10 inches below the mean annual rainfall for the area. (USGS)
W81-02979

HEXAVALENT CHROMIUM IN GROUND AND SURFACE WATERS NEAR TELLURIDE, COLORADO -- A PRELIMINARY DATA REPORT --,

Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-02982

LITHOLOGIC LOGS AND GEOPHYSICAL LOGS FROM TEST DRILLING IN PALM BEACH COUNTY, FLORIDA, SINCE 1974,
Geological Survey, Tallahassee, FL. Water Resources Div.
L. J. Swayze, M. C. McGovern, and J. N. Fischer.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $12.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-68, 1980. 93 p, 1 Fig, 1 Tab, 4 Ref.

Descriptors: Geology, *Lithologic logs, *Borehole geophysics, Test wells, Florida, *Palm Beach County.

Test-hole data that may be used to determine the hydrogeology of the zone of high permeability in Palm Beach County, Fla., are presented. Lithologic logs from 46 test wells and geophysical logs from 40 test wells are contained in this report. (USGS)
W81-02983

QUALITY OF SURFACE WATER AT SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA, APRIL 1978 TO DECEMBER 1979,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Coffin.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $16.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-76, 1981. 118 p, 33 Fig, 19 Tab, 13 Ref.

Descriptors: *Water quality, *Surface water, *River basins, Monitoring, Water sampling, Sites, Data collections, Chemical analysis, Hydrologic data, Water analysis, Florida, *Suwannee River basin.

This report presents the results of analyses of water-quality samples collected from 13 surface-water sites in the Suwannee River basin in Florida from April 1978 to December 1979. Samples collected routinely included: nutrients, total organic carbon, and 5-day biological oxygen demand, bimonthly; trace metals, annually. The array of constituents sampled was expanded in October 1978 at three of the original nine stations to provide quality-of-water information for streams draining an industrial area: Rocky Creek near Belmont, Hunter Creek near Belmont, and Swift Creek at Facil. Data collected at these three sites now include: major chemical constituents, six times per year; radium-226, two times per year; and trace metals, one time per year. These constituents are determined in addition to nutrients, total organic carbon, and biological oxygen demand which continue to be collected six times per year. All results of analyses of the water-quality samples collected from April 1978 to December 1979 remained within, or near, previously measured ranges and water-quality fluctuations were similar to those noted from data collected since 1970. (USGS)
W81-02984

SURFACE-WATER DATA FOR IDAHO, 1971-75,
Geological Survey, Boise, ID. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $103.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 80-2041, September, 1980. S.C. Cordes, Compiler. 775 p, 1 Fig.

Descriptors: *Idaho, *Hydrologic data, *Surface waters, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Data collections, Sites.

Surface-water data for Idaho for the 5-year period 1971-1975 are presented in this report. Data consist of 242 records of stage or discharge of streams, and contents of 30 lakes or reservoirs. Also included are data for 109 crest-stage partial-record stations and 194 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W81-02991

WATER-LEVEL MAP OF THE MISSISSIPPI DELTA ALLUVIUM IN NORTHWESTERN MISSISSIPPI, SEPTEMBER 1980,
Geological Survey, Jackson, MS. Water Resources Div.
B. E. Wasson.
Mississippi Bureau of Land and Water Resources, Water Resources Map 80-1, 1980. 1 Fig, 3 Ref, 1 Sheet.

Descriptors: *Maps, *Water level, *Groundwater, *Alluvial aquifer, Aquifer characteristics, Deltas, Wells, Water level fluctuations, Pumping, Irrigation, Industrial water, Groundwater recharge, Groundwater movement, Mississippi, *Mississippi Delta.

Water levels were measured in about 500 wells in the alluvial sediments in northwestern Mississippi during the period September 8-26, 1980. Groundwater movement in the alluvial sands and gravel in the Mississippi River valley alluvial aquifer is generally southward, and large depressions in the surface of the groundwater body were detected near the city of Cleveland, the Sunflower-Leflore County area, and northcentral Tallahatchie County. These depressions are attributed to heavy agricultural pumping for rice irrigation and catfish farming. Other smaller but deeper depressions were detected at Clarksdale and Greenwood--these are attributed to year-round industrial pumping. (USGS)
W81-02996

AVAILABILITY OF SURFACE WATER IN AUTAUGA COUNTY, ALABAMA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. R. Willmon.
Alabama Geological Survey Map 156, 1980. 9 p, 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Available water, *Surface water, *Streamflow, *Water quality, Flow rates, Water yield, Low flow, Rainfall-runoff relationships, Hydrologic data, Chemical analysis, Water temperature, Potential water supply, Maps, *Alabama, *Autauga County.

Autauga County comprises an area of 599 square miles in central Alabama. Average annual precipitation in the county is about 52 inches or 1,480 million gallons per day. About 60% or 880 million gallons per day of the precipitation returns to the atmosphere through evapotranspiration and the remaining 40% or 600 million gallons per day runs off in streams. Surface runoff in the county is 1.0 million gallons per day per square mile. Streamflow is highest during the winter and spring (January through April), the period of highest rainfall and lowest evapotranspiration, and is lowest in September and October. Average annual flow of each of the larger streams within the county, which include Mulberry, Little Mulberry, Swift, Autauga, and Bridge Creeks, ranges from 40 to 240 million gallons per day; and the median annual 7-day minimum flow of these streams ranges from 15 to 55 million gallons per day. The Alabama River, which forms the southern boundary of the county, has an average flow of 14,900 million gallons per day and a median annual 7-day minimum flow of 5,000 million gallons per day where it enters the county. The water in streams throughout the county is soft and has a low mineral content. (USGS)
W81-02997

WATER AVAILABILITY AND GEOLOGY OF SUMTER COUNTY, ALABAMA,
Geological Survey, University, AL. Water Resources Div.
M. E. Davis, T. H. Sanford, Jr., and P. O. Jefferson.
Alabama Geological Survey Map 158, 1980. 69 p, 7 Fig, 6 Tab, 23 Ref.

Descriptors: *Available water, *Surface water, *Groundwater, *Water quality, Water yield, Stream-flow, Wells, Aquifers, Hydrologic budget, Geohydrology, Well data, Chemical analysis, Potential water supply, Hydrologic data, Maps, Evaluation, *Alabama, *Sumter County.

Geologic units that crop out in Sumter County, Ala., include the Selma Group of Late Cretaceous age, the Midway and Wilcox Groups of Tertiary age, and terrace deposits and alluvium of Quaternary age. Potential sources of large supplies of groundwater are major aquifers in the Coker, Gordo, and Eutaw Formations; expected yields are 1.5 mgd (million gallons per day) or more per well. The average annual runoff originating in Sumter County is about 17 inches or 0.8 mgd per square mile. The Tombigbee River, the largest potential source of surface water in the county, has an average flow of about 15,100 mgd and a median annual 7-day low flow in excess of 900 mgd where it leaves the county. Noxubee and Sucarnoochee Rivers and their tributaries also are potential sources of surface water. These rivers have average flows in excess of 700 mgd and median annual 7-day low flows in excess of 30 mgd along their lower reaches. Water from most streams in the county contains less than 30 mg/l (milligrams per liter) chloride. The hardness ranges from soft to hard. The iron content and color of the water in some streams may be objectionable for some uses. Water from the major aquifers underlying the northern part of the county generally contains less than 500 mg/l chloride, less than 0.3 mg/l iron, and is soft to moderatley hard; however, in the central and southern parts of the county, water from the major aquifers contains more than 500 mg/l chloride. Water from minor aquifers contains less than 20 mg/l chloride but locally contains more than 0.3 mg/l iron. Water use in Sumter County in 1968 was 1.7 mgd, most of which was from surface-water sources. Less than 1% of the potential water resources was being utilized. (USGS)
W81-02998

AVAILABILITY OF SURFACE WATER IN MONTGOMERY COUNTY, ALABAMA,
Geological Survey, Lakewood, CO. Water Resources Div.
J. R. Willmon.
Alabama Geological Survey Map 157, 1980. 8 p, 4 Fig, 1 Tab, 14 Ref.

Descriptors: *Available water, *Surface water, *Streamflow, *Water quality, Flow rates, Water yield, Low flow, Hydrology, Rainfall-runoff relationships, Hydrologic data, Chemical analysis, Water temperature, Potential water supply, Maps, *Alabama, *Montgomery County.

Average annual precipitation that falls on Montgomery County is about 50 inches, or 1,880 mgd (million gallons per day). Approximately 65% or 1,220 mgd of this water returns to the atmosphere through evapotranspiration and the remaining 35% or 660 mgd runs off in streams. Surface runoff from the county averages about 0.8 mgd per square mile. Streamflow is highest during the winter and spring, December-April, the period of highest rainfall and lowest evapotranspiration. The Alabama River and Tallapoosa River, which form the northern boundary of the county, are the largest streams in the county. The Alabama River has an average flow of 15,300 mgd where it flows out of the county and the Tallapoosa River has an average flow of 4,200 mgd where it joins the Coosa River to form the Alabama River. The median annual 7-day minimum flow of each stream exceeds 1,000 mgd. Catoma, Line, and Pintlalla Creeks, the principal creeks in the county, have average flows of 280 mgd, 250 mgd, and 210 mgd, respectively, and each has a median annual 7-day minimum flow of less than 2 mgd. Water in streams in the county is suitable for most uses. The

water is soft to hard, has a dissolved-solids content of less than 200 mg/l (milligrams per liter), and a chloride content of less than 20 mg/l. (USGS)
W81-02999

HYDROLOGIC AND LAND-COVER FEATURES OF THE LOXAHATCHEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
B. F. McPherson, and M. Sabanskas.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $14.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1109 (WRI), 1980. 5 Fig, 2 Tab, 12 Ref, 1 Sheet.

Descriptors: *Maps, *Watersheds, *Land use, *River basins, Topography, Water management, Wetlands, Agriculture, Soil types, Water level fluctuations, Salinity, *Florida, *Loxahatchee River basin.

Historically the Loxahatchee River basin covered about 270 square miles in southeast Florida. Today the basin covers about 210 square miles and is defined by both topography, manmade features, and water-management policies. About 50% of the basin is wetlands. Urban and agricultural lands cover 17 and 18% of the basin, respectively. Soils are predominantly sandy and poorly drained. Water drains into the estuary, a shallow water body of about 2 square miles. (USGS)
W81-03000

HOW TO COPE WITH THE SDWA/II,
E. L. MacLeman.
Water and Wastes Engineering, Vol 17, No 5, p 33-37, May, 1980. 7 Fig, 1 Tab.

Descriptors: *Water analysis, *Safe Drinking Water Act, *Documentation, Membrane filter method, Data processing, Regulations, Water quality, *Potable water, Bacteria, Monitoring, Sampling.

Simplified forms are presented for recording drinking water analysis data on chemicals and bacteriological content obtained by the membrane filter method. The National Interim Primary Drinking Water Regulations require reporting at stated intervals. The forms are compatible with all EPA Model States Information Systems and may lead to fewer errors, less time consumed, easier compliance, and better management. (Cassar-FRC)
W81-03209

8. ENGINEERING WORKS

8A. Structures

ANALYTICAL NOTE: CATALYTIC EFFECTS OF SULFUR AND OTHER COMPOUNDS IN THE AZIDE-IODINE TEST,
Ohio State Univ., Columbus. Dept. of Microbiology.
O. H. Tuovinen, W. J. Lapple, and D. M. Mair.
Journal of the American Water Works Association, Vol 73, No 2, p 126, February, 1981. 2 Tab, 3 Ref.

Descriptors: *Castings, *Corrosion control, *Sulfides, Corrosion, *Pipelines, Pitting(Corrosion), Chemical degradation, Damages, Inorganic compounds, Sulfur compounds, Pyrite.

In the search for a rapid and qualitative field test for evaluating soil aggressiveness in pipeline installations via the presence of reduced sulfur in cast iron corrosion products, the applicability of the azide-iodide test was appraised. The procedure involved flooding a sample on a microscope slide with the test solution (0.46 M NaN2 in 0.1 N 12) followed by observation of the gas evolution for up to 2 min under a microscope with 100-fold magnification. The data indicate that the azide-iodine reaction is readily catalyzed by various compounds of sulfur. As other compounds also gave positive reactions, this test should receive only limited use. Erroneous data may result. Thus it was concluded that the test was not sufficiently specific for testing reduced sulfur compounds in corroded specimens. (Baker-FRC)
W81-03146

DREDGING VESSEL,
Ballast-Nedam Groep, N.V., Amstelveen (Netherlands). (Assignee); and Amsterdamse Ballast Bagger en Grond (Netherlands).
P. J. H. Nieuwendijk.
U.S. Patent No 4,206,057, 5 p, 4 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 995, No 1, p 229, June 3, 1980.

Descriptors: *Patents, *Dredging, *Channel improvement, *Sediment control, Siphons, Ships, Water quality control, Dredging equipment, Navigation.

The invention relates to a dredging vessel comprising a loading space for receiving spoil and at least two effluent devices for conducting the head water standing above the settled sand away. When the loading space is filled with sand containing much sludge or another pollutant, the head water will be seriously polluted. In order to avoid pollution the head water can be conducted away beyond the stream range around the vessel and located near the bottom so that the particles floating in the head water will readily settle on the ground and not spread over a large region. The effluent devices are comprised of a tubular sheath, inside which is telescopically arranged a level-adjustable, common outlet conduit which can be withdrawn into the tubular sheath and be brought out to a considerable distance below the vessel. The level-adjustable, common outlet conduit has an outlet extending, during the loading operation, beneath the vessel and being brought beyond the water stream moving beneath the vessel. (Sinha-OEIS)
W81-03154

8B. Hydraulics

HYDRAULICS OF CLOSED CONDUIT SPILLWAYS, PART XVI: ELBOWS AND TRANSITIONS FOR THE TWO-WAY DROP INLET,
Science and Education Administration, Minneapolis, MN.
C. L. Anderson.
Advances in Agricultural Technology AAT-NC-1, February, 1979. 47 p, 21 Fig, 11 Tab, 7 Ref.

Descriptors: *Cavitation, *Closed-conduit flow, *Inlets, *Hydraulic design, *Spillways, Fluid mechanics, Model studies, Hydraulic properties, Energy loss.

Cavitation damage may occur in tall closed conduit spillways. For drop inlet spillway entrances, a likely place for cavitation damage to occur is in the barrel just downstream from the drop inlet. The objective of this study is to develop and evaluate a cavitation-free elbow between the drop inlet and a transition, and a cavitation-free transition between the square cross section at the elbow exit and a circular barrel. Six elbows (1 through 6) and seven transitions (A through G) were evaluated using both water and air as the test fluids. Two elbo shapes, elbows 3 and 6, and two transition shapes, transitions A and F are recommended. Elbow 3 is an elipse with a curvature of 2 D x D. Elbow 6 is comprised of two circular arcs. The upstream arc has a radius of D/2 and an angle of 45 degrees. The following arc has a radius of 3D/2 and an angle of up to 45 degrees. Transition A is 2D long, has a semicylindrical invert of D/2 radius laid on the barrel slope, plane vertical triangular sides, a plane isosceles triangular top, and oblique quarter cones between the vertical sides and the top. Transition F is 1D long, has a plane isosceles triangular top with a base of D length at the upstream end and laid on the barrel slope, and warped sides between the triangular top and the barrel. The barrel entrance energy loss coefficients for all combinations of elbows 3 and 6 with transitions A and F are identical and vary only with drop inlet length. The coefficients for elbows 3 and 6 when used with square barrels are also identical. (Moore-SRC)
W81-02963

8C. Hydraulic Machinery

TEST DRILLING IN BASALTS, LALAMILO AREA, SOUTH KOHALA DISTRICT, HAWAII,
Geological Survey, Honolulu, HI. Water Resources Div.
W. E. Teasdale.
Available from the OFSS, USGS Box 25425, Fed. Ctr., Denver, CO 80225, Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 80-1299, December, 1980. 26 p, 11 Fig.

Descriptors: *Core drilling, *Basalts, *Drilling equipment, *Drilling fluids, Boreholes, Groundwater, Water table, *Hawaii, South Kohala District, Lalamilo area.

Test drilling has determined that a downhole-percussion airhammer can be used effectively to drill basalts in Hawaii. When used in conjunction with a foam-type drilling fluid, the hammer-bit penetration rate was rapid. Continuous drill cuttings from the materials penetrated were obtained throughout the borehole except from extremely fractured or weathered basalt zones where circulation was lost or limited. Cementing of these zones as soon as encountered reduced problems of stuck tools, washouts, and loss of drill-cuttings. Supplies and logistics on the Hawaiian Islands, always a major concern, require that all anticipated drilling supplies, spare rig and tool parts, drilling muds and additives, foam, and miscellaneous hardware be on hand before starting to drill. If not, the resulting rig downtime is costly in both time and money. (USGS)
W81-02987

8G. Materials

ANALYTICAL NOTE: CATALYTIC EFFECTS OF SULFUR AND OTHER COMPOUNDS IN THE AZIDE-IODINE TEST,
Ohio State Univ., Columbus. Dept. of Microbiology.
For primary bibliographic entry see Field 8A.
W81-03146

8I. Fisheries Engineering

EFFECTIVENESS OF FINE MESH CYLINDRICAL WEDGE-WIRE SCREENS IN REDUCING ENTRAINMENT OF LAKE MICHIGAN ICHTHYOPLANKTON,
Consumers Power Co., Jackson, MI. Dept. of Environmental Services.
I. H. Zeitoun, J. A. Gulvas, and D. B. Roarabaugh.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 38, No 1, p 120-125, January, 1981. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Fish eggs, *Larvae, *Powerplants, Entrainment, Intakes, Screens, Aquatic life, Fry, *Lake Michigan, Fish management, Wildlife management, *Zooplankton, Ecology.

Entrainment of fish larvae and eggs into power plant intakes was studied in Lake Michigan using cylindrical screens with 2.0-mm and 9.5-mm openings. The control was an open, unscreened pipe. Ambient concentrations of ichthyoplankton were determined by tow net collection. About 90% of the fish larvae (rainbow smelt, alewife, and yellow perch) escaped entrainment, primarily by avoidance and to a lesser extent by screen exclusion. There was no significant difference between the two screen sizes with respect to aquatic life entrained. During the June-August 1979 studies, eggs reached a maximum of 241 eggs per 1,000 cu meters, compared with 5.9 eggs per 1,000 cu meters collected in tow samples. Overall larvae entrainment was 12.5 per 1,000 cu meters through the screens and 18.3 per 1,000 cu meters through the open pipe; larvae collected in tows were 149.4

per 1,000 cu meters. Entrainment varied with species, month and time of day. In August entrainment of minnows was less than in June and July because they were better able to detect the screens and swim away from the currents. Larvae also migrated offshore as they grew larger. (Cassar-FRC)
W81-03126

GROUNDWATER IS BEST FOR HATCHERY FISH,
P. W. Querna.
Johnson Drillers Journal, Vol 52, No 6, p 7, 10, 11, November/December, 1980.

Descriptors: *Water wells, *Fish hatcheries, Wells, *Groundwater, Water quality, Water temperature, Drilling, Snake River, Washington, Marmes Rock Shelter, Dams, Lower Monumental Dam, Aquifers, Spokane flood aquifer.

The Lyons Ferry Fish Hatchery on the Snake River in southeast Washington is supplied with water from 8 production wells drilled starting in 1978 under supervision of the Corps of Engineers. The water source, the Spokane Flood sand and gravel aquifer, was discovered during work to preserve the Marmes Rock Shelter archeological dig from the rising waters of the Lower Monumental Dam on the Snake River. Water temperature in the first 2 test 16 inch wells was 51 to 56F. Analyses showed acceptable levels of pesticides, chemicals and bacteria. Total requirement for the hatchery is 48,000 gallons per minute. (Cassar-FRC)
W81-03228

ATMOSPHERIC GAS SUPERSATURATION: EDUCATIONAL AND RESEARCH NEEDS,
National Fisheries Research Center, Seattle, WA.
For primary bibliographic entry see Field 5C.
W81-03245

FEASIBILITY OF SIPHONS FOR DEGASSING WATER,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
B. H. Monk, C. W. Long, and E. M. Dawley.
Transactions of the American Fisheries Society, Vol 109, No 6, p 765-768, November, 1980. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Supersaturation, *Siphons, *Water pollution treatment, Degassing water, Turbulent flow, Feasibility studies, Hydraulic equipment, Nitrogen, *Fisheries, Engineering, Fish diseases.

The ability of siphons to degas water was evaluated in an effort to find a simple solution to the problem of supersaturation. During tests the following were varied: the vacuum head, the hydraulic or static head, the length of the siphon apex, turbulence, and the dissolved gas content of the water supply. The siphons tested did an effective job of degassing water. Siphons of unmodified hoses with a 5.1 cm hose ID (61.0 m long) decreased nitrogen saturation from 115% to 87% in about 30 seconds. Increased turbulence, induced by reducing the diameter of the siphon, increasing the water velocity within the same size siphon, or adding static mixers, enhanced degassing efficiency. 5.1-cm hoses were more efficient than 10.2-cm hoses, probably because of greater turbulence. Static mixers in a 4.6-m long apex lowered gas content from 113 to 90% in less than 5 seconds, whereas the 10.2-cm ID siphon with 35.1 m of coiled hose at the apex required 30 seconds to lower gas content from 111 to 94%. Turbulence appeared to be more important than length of treatment. (Small-FRC)
W81-03248

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ECONOMICS,
Clemson Univ., SC.
For primary bibliographic entry see Field 6C.
W81-03159

LAW,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 6E.
W81-03160

INORGANICS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W81-03161

10F. Preparation Of Reviews

SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 6A.
W81-03158

WATER CHARACTERISTICS,
Missouri Univ., Kansas City.
For primary bibliographic entry see Field 5B.
W81-03162

ORGANICS,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 5A.
W81-03163

PHYSICAL AND CHEMICAL METHODS,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 5D.
W81-03164

BIOLOGICAL FILTERS,
Colorado State Univ. at Boulder.
For primary bibliographic entry see Field 5D.
W81-03165

LAGOONS AND OXIDATION PONDS,
Utah State Univ., Logan. Div. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W81-03166

ANAEROBIC PROCESSES,
Institute of Gas Technology, Chicago, IL.
For primary bibliographic entry see Field 5G.
W81-03167

DENITRIFICATION,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5D.
W81-03168

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-03169

OPERATION AND MAINTENANCE OF WASTE WATER COLLECTION AND TREATMENT FACILITIES,
Montgomery (James M.), Pasadena, CA.
For primary bibliographic entry see Field 5D.
W81-03171

DISINFECTION,
Rensselaer Polytechnic Inst., Troy, NY.
For primary bibliographic entry see Field 5F.
W81-03172

WASTEWATER COLLECTION,
Sewer System Evaluations, Inc., Chicago, IL.
For primary bibliographic entry see Field 5D.
W81-03173

WATER RECLAMATION AND REUSE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-03174

URBAN RUNOFF AND COMBINED SEWER OVERFLOW,
Environmental Protection Agency, Edison, NJ.
For primary bibliographic entry see Field 5B.
W81-03176

INSTRUMENTATION AND AUTOMATION OF WASTE WATER COLLECTION AND TREATMENT SYSTEMS,
Environmental Research Lab., Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5D.
W81-03177

MEAT, FISH, AND POULTRY PROCESSING WASTES,
Battelle Columbus Lab., OH.
For primary bibliographic entry see Field 5D.
W81-03179

FRUIT, VEGETABLE, AND GRAIN PROCESSING WASTES,
Kramer, Chin and Mayo, Inc., Seattle, WA.
For primary bibliographic entry see Field 5D.
W81-03180

FERMENTATION INDUSTRY,
Notre Dame Univ., IN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-03181

DARIY WASTES,
Kraft, Inc., Glenview, IL.
For primary bibliographic entry see Field 5D.
W81-03182

AGRICULTURAL WASTES,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W81-03183

TEXTILE WASTES,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W81-03184

PULP AND PAPER INDUSTRY WASTE WATER MANAGEMENT,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
For primary bibliographic entry see Field 5D.
W81-03185

DISEASE OUTBREAKS CAUSED BY DRINKING WATER,
Harvard School of Public Health, Boston, MA.
For primary bibliographic entry see Field 5C.
W81-03186

MICROBIOLOGY - DETECTION, OCCURRENCE, AND REMOVAL OF VIRUSES,
New Orleans Univ., LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W81-03187

MICROBIOLOGY OF WASTE WATER TREATMENT,
Drexel Univ., Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W81-03188

SUBJECT INDEX

ABSORPTION
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

ACETATE
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

ACID DRAINAGE
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

ACID MINE DRAINAGE
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

ACID MINE WATER
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

ACID RAIN
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

ACIDIC WATER
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

Report on Health and Environmental Effects of Increased Coal Utilization, by the Committee on Health and Environmental Effects of Increased Coal Utilization.
W81-03217 5C

ACIDIC WATERS
The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

ACTIVATED CARBON
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

Active Carbon Adsorption,
W81-03046 5D

Carbon Regeneration,
W81-03048 5D

Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column,
W81-03097 5F

Principles of Dye Removal from Textile Effluent,
W81-03249 5D

ACTIVATED SLUDGE
Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

Albany County Sewer District, New York,
W81-03239 5D

Gas-Liquid Dissolution in Waste Water Treatment,
W81-03247 5D

ACTIVATED SLUDGE PROCESS
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

ADMINISTRATION
Operational Guidelines,
W81-03050 5D

ADSORBENTS
Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

Active Carbon Adsorption,
W81-03046 5D

Carbon Regeneration,
W81-03048 5D

AERATED LAGOONS
Lagoons and Oxidation Ponds,
W81-03166 5D

AERATION
Multiple Stage Jet Nozzle and Aeration System,
W81-03034 5D

AEROBIC TREATMENT
Method and Apparatus for Treating Sewage,
W81-03018 5D

AFRICA
Distribution and Ecology of Marine Fungi in Sierra Leone (Tropical West Africa),
W81-03214 5B

AGGRADATION
Unsteady Sediment Transport Law and Prediction of Aggradation Parameters,
W81-03053 2J

AGRICULTURAL CHEMICALS
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

AGRICULTURAL RUNOFF
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

AGRICULTURAL WASTES
Agricultural Wastes,
W81-03183 5D

AGRICULTURAL WATERSHEDS
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

AGRICULTURE
Water Reclamation and Reuse,
W81-03174 5D

Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

AIR POLLUTION
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

AIR-SUPERSATURATED WATER
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

ALABAMA
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

ALASKA
Alaska Village Demonstration Projects, Final Report,
W81-02944 5D

Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

ALGAE
Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

ALKALINITY
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

ALLUVIAL AQUIFER
Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

AMINO ACIDS
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

AMMONIA
Ammonia Stripping,
W81-03041 5D

AMMONIA

Chlorine Disinfection,
W81-03044 5D

AMMONIUM COMPOUNDS
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

ANAEROBIC BACTERIA
Anaerobic Processes,
W81-03167 5G

ANALYTICAL TECHNIQUES
The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters,
W81-03103 7B

Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

Inorganics,
W81-03161 5A

ANION EXCHANGE
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances.
W81-03004 3A

ANTARCTICA
Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

APALACHICOLA BAY
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

AQUATIC ANIMALS
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

AQUATIC ENVIRONMENT
Methods for Estimating the Number of Identifiable Organic Pollutants in the Aquatic Environment,
W81-03069 5A

AQUATIC FUNGI
Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

AQUATIC POPULATIONS
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

AQUATIC SYSTEMS
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

AQUIFER CHARACTERISTICS
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

AQUIFER TESTING
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

Pumping Test Analyses for Low Yield Formations,
W81-03229 7B

AQUIFERS
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

ARID LANDS
Unsaturated Flow in an Arid Environment,
W81-02911 2F

ARIZONA
Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

AROMATIC COMPOUNDS
The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

ATLANTIC OCEAN
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

AUSTIN
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

AUSTRALIA
Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

AUTAUGA COUNTY
Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

AUTOMATION
Computer-Controlled Irrigation System,
W81-03016 3F

AVAILABLE WATER
Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

BACTERIA
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

Poor Sludge Settleability Caused by the Bacterium Lampropedia,
W81-03139 5D

BARRIERS
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

BASALTS
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

BASE FLOW
Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

BASELINE STUDIES
Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

BEACH EROSION
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

BED LOAD
Measurement and Computation of Bed-Material Discharge in a Shallow Sand-Bed Stream, Muddy Creek, Wyoming,
W81-03060 2J

BEDROCK
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

BENTHIC FAUNA
Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

BENTHIC FLORA
Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

BIOACCUMULATION
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

BIODEGRADATION
The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

Anaerobic Processes,
W81-03167 5G

BIOLOGICAL FILTERS
Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

Biological Filters,
W81-03165 5D

BIOLOGICAL TREATMENT
Treatment Improved through Process Control,
W81-03142 5D

Anaerobic Processes,
W81-03167 5G

BLEACHING WASTES
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

BOISE
They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

BOREHOLE GEOPHYSICS
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

BOTTLED WATER
Bottled Water: Expensive Groundwater,
W81-03153 5A

BRINES
Surface Containment for Geothermal Brines,
W81-02955 5G

CALIFORNIA
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
W81-02921 7B

Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

Water Reuse: Projecting Markets and Costs,
W81-03072 3C

Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

CANADA
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

CARBAMATE PESTICIDES
Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

CARBON RADIOISOTOPES
Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

CASTINGS
Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

CATION EXCHANGE
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances.
W81-03004 3A

CAVITATION
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

CHANNEL IMPROVEMENT
Dredging Vessel,
W81-03154 8A

CHELATION
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

CHEMICAL ANALYSIS
Organics,
W81-03163 5A

CHEMICAL PRECIPITATION
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

CHEMICAL REACTIONS
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

CHEMICAL TREATMENT
Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

CHEMICAL WASTES
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

CHESAPEAKE BAY
Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

CHLORAMINATION
Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

CHLORAMINES
Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

CHLORINATED HYDROCARBONS
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

CHLORINATION
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

Chlorine Disinfection,
W81-03044 5D

Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

CHLORINE DIOXIDE
A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

CHLOROFORM
High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

CHROMATOGRAPHY
High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

CHROMIUM
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

CHROMIUM COMPOUNDS
Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

CLARIFICATION
Clarification,
W81-03039 5D

CLEANUP OPERATIONS
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

CLOSED-CONDUIT FLOW
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

COAGULATION
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

COAL
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

COAL INDUSTRY
Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

COAL MINE WASTES
Report on Health and Environmental Effects of Increased Coal Utilization, by the Committee on Health and Environmental Effects of Increased Coal Utilization.
W81-03217 5C

COAL MINES
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

COAL MINING
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

COAL MINING POTENTIAL
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

COAL UTILIZATION EFFECTS
Report on Health and Environmental Effects of Increased Coal Utilization, by the Committee on Health and Environmental Effects of Increased Coal Utilization.
W81-03217 5C

COASTAL WATERS
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

COASTAL ZONE MANAGEMENT
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

COLIFORMS
Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

COLORADO
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

COLORADO RIVER BASIN
Environmental Issues: Still Clouded in Uncertainty,
W81-03107 5C

COLUMBIA RIVER
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

COMBINED SEWER OVERFLOWS
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

COMPUTER MODELS
Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

COMPUTERS
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

CONFERENCES
Minority Water Awareness Program.
W81-02910 6E

CONNECTICUT RIVER
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

CONSTRUCTION
Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing,
W81-03073 3D

CONSTRUCTION COSTS
The EPA Value Engineering Program. Part I: What it is and What it does,
W81-03081 6B

The EPA Value Engineering Program: Part II,
W81-03082 6A

CONTROL SYSTEMS
Computer-Controlled Irrigation System,
W81-03016 3F

Operational Guidelines,
W81-03050 5D

COOLING WATER
Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

COPPER
Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

CORE DRILLING
Test Drilling in Basalts, Lalamilo Area, South Kohaia District, Hawaii,
W81-02987 8C

CORROSION CONTROL
Final Treatment,
W81-03049 5D

Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

COST ALLOCATIONS
Economics,
W81-03159 6C

COST ANALYSIS
The EPA Value Engineering Program: Part II,
W81-03082 6A

A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

Guide to Comparative Treatment Mode Efficiencies,
W81-03190 5D

COST-BENEFIT RATIO
Evaluating Costs and Benefits of Alternative Disinfectants,
W81-03078 5F

COSTS
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

CROP PRODUCTION
Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

CRUSTACEANS
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

CYANIDE
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

DAIRY INDUSTRY
Dariy Wastes,
W81-03182 5D

DALLAS
Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

DAPHNIA
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

DATA ACQUISITION
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

DATA COLLECTIONS
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

DATA INTERPRETATION
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

DATA STORAGE AND RETRIEVAL
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

DEBRIS BASINS
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

DECISION MAKING
Minority Water Awareness Program.
W81-02910 6E

DEEP WELLS
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

DELAWARE RIVER
The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

DELTAS
Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
W81-02921 7B

DENITRIFICATION
Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

Denitrification,
W81-03168 5D

DENVER
Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing.
W81-03073 3D

DESALINATION
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances.
W81-03004 3A

Solar Desalination System,
W81-03029 3A

DESALINATION PLANTS
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

DESALINATION PROCESSES
Solar Desalination System,
W81-03029 3A

DESERT PLANTS
Daily Fluctuations in Water Potential and Associated Ionic Changes in Atriplex Canescens,
W81-03250 2D

DESIGN CRITERIA
Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

Wastewater Collection,
W81-03173 5D

DESTRATIFICATION
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

DEWATERING
Sludge Dewatering,
W81-03047 5D

DIAZINON
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

DIFFUSION
Comment on 'Analysis of Water and Heat Flow in Unsaturated-Saturated Porous Media' by Marios Sophocleous,
W81-03085 2G

DISEASES
Disease Outbreaks Caused by Drinking Water,
W81-03186 5C

DISINFECTION
Chlorine Disinfection,
W81-03044 5D

Ozone Disinfection,
W81-03045 5D

Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

Evaluating Costs and Benefits of Alternative Disinfectants,
W81-03078 5F

Disinfection,
W81-03172 5F

DISSOLVED OXYGEN
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

Gas-Liquid Dissolution in Waste Water Treatment.
W81-03247 5D

DISTRIBUTION PATTERN
Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

DISTRIBUTION SYSTEMS
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

DIURNAL DISTRIBUTION
Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

DOCUMENTATION
How to Cope with the SDWA/II,
W81-03209 7C

DOMESTIC WASTES
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

DOMESTIC WATER
Magnetic Treatment Devices for Water Pipelines,
W81-03035 5G

DRAINAGE AREA
West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

DRAWDOWN
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

DREDGING
Dredging Vessel,
W81-03154 8A

DRILLING EQUIPMENT
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

DRILLING FLUIDS
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

DRINKING WATER
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead.,
W81-03141 5F

Bottled Water: Expensive Groundwater,
W81-03153 5A

A Review of Water Quality Problems Caused by Various Open Distribution Storage Reservoirs,
W81-03218 5B

DRIP IRRIGATION
Drip Level Irrigation Emitter Unit.
W81-03017 3F

Drip Irrigation System,
W81-03028 3F

DROUGHT
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

DROUGHT RESISTANCE
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

DUCKS
Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

DUSTS
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

DYES
Principles of Dye Removal from Textile Effluent,
W81-03249 5D

EAGLE RIVER VALLEY
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

ECOLOGICAL EFFECTS
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

ECOLOGY
Evolution of Management Policy and Research in the National Parks,
W81-03120 6G

Distribution and Ecology of Marine Fungi in Sierra Leone (Tropical West Africa),
W81-03214 5B

ECONOMIC ASPECTS
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

Economics,
W81-03159 6C

ECOSYSTEMS
Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

EDUCATION
Minority Water Awareness Program.
W81-02910 6E

EFFLUENTS
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

ELECTRIC POWER PLANTS
Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

ENERGY CONVERSION
Toronto Turns Sludge into Energy,
W81-03112 5E

ENGLAND
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

ENTEROVIRUSES
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

ENVIRONMENTAL EFFECTS
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

Environmental Issues: Still Clouded in Uncertainty,
W81-03107 5C

EQUALIZATION RESERVOIRS
Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

EQUALIZING BASINS
Quality Equalization,
W81-03040 5D

EROSION
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

EROSION CONTROL
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

ESTIMATING
Methods for Estimating the Number of Identifiable Organic Pollutants in the Aquatic Environment,
W81-03069 5A

ESTUARIES
Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

ESTUARINE ENVIRONMENT
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

ETHOPROP
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

EUGLENA GRACILIS
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

EUTROPHICATION
The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

EVAPORATION RATE
Water Budget Computation in Lake Okeechobee,
W81-03100 2D

EVAPORATORS
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

EVAPOTRANSPIRATION
Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

FARM LAGOONS
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

FARM MANAGEMENT
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

FARM WASTES
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

Agricultural Wastes,
W81-03183 5D

Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

FERMENTATION
Fermentation Industry,
W81-03181 5D

FERTILIZERS
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

FILTERS
Filtration,
W81-03043 5D

Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

FILTRATION
Filtration,
W81-03043 5D

Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

FISH
Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

The Role of Fishes in the Regulation of Phosphorus Availability in Lakes,
W81-03226 2H

FISH BEHAVIOR
Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

FISH DISEASES
Etiology of Gas Bubble Disease,
W81-03241 5C

Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

FISH EGGS
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

FISH HATCHERIES
Groundwater Is Best for Hatchery Fish,
W81-03228 8I

FISH POLLUTION
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

FISH POPULATIONS
Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

FISH REPRODUCTION
Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

FISHERIES
Feasibility of Siphons for Degassing Water,
W81-03248 8I

FISHKILLS
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

FISSURES (GEOLOGIC)
Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

FLOCCULATION
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

FLOOD FORECASTING
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

FLOOD PEAK
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

FLOODS
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

FLOODWATER
Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

FLORIDA
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

FLOW CONTROL
Drip Level Irrigation Emitter Unit,
W81-03017 3F

FLOW RATES
Flow Through Fractures,
W81-03064 2F

FLUORIDES
Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

FLY ASH
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

FOAM SEPARATION
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

FOOD CHAINS
Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

FOOD-PROCESSING WASTES
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

Fermentation Industry,
W81-03181 5D

FORESTRY
Comments to the U.S. Army Corps of Engineers Regarding Proposed Regulations on Implementing Section 404 of the Clean Water Act: A Position of the Society of American Foresters.
W81-03134 4A

FORESTS
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

FOULING
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

Final Treatment,
W81-03049 5D

FRACTURE PERMEABILITY
Flow Through Fractures,
W81-03064 2F

FRANCE
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

Evaluation of Lipids and Their Elimination in *Different Types of Small Capacity Purification* Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations *D'Epuration de Petite Capacite*),
W81-03216 5D

FULVIC ACIDS
A Method for Evaluating the Acid-Base Balance in Natural Waters,
W81-03212 5A

FUNGI
Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

GAS CHROMATOGRAPHY
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

GAS LIQUID CHROMATOGRAPHY
Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

GASES
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

GEOCHEMISTRY
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

GEOHYDROLOGIC BOUNDARIES
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

GEOHYDROLOGY
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

GEOLOGY
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

GEOTHERMAL POWER
Surface Containment for Geothermal Brines,
W81-02955 5G

GEOTHERMAL STUDIES
Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

GLACIATION
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

GREAT LAKES
Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

GROUND-RECHARGING
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

GROUNDWATER
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore *of Buzzards Bay*,
W81-02917 7C

Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

Groundwater Is Best for Hatchery Fish,
W81-03228 8I

GROUNDWATER AVAILABILITY
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

GROUNDWATER BASINS
A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

GROUNDWATER CONTAMINATION
Groundwater Resources Management,
W81-03220 4B

GROUNDWATER HYDROLOGY
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

GROUNDWATER LEVEL
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

GROUNDWATER MANAGEMENT
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

The Case for Regional Groundwater Management,
W81-03132 6B

Groundwater Resources Management,
W81-03220 4B

GROUNDWATER MOVEMENT
A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

Underground Travel of Renovated Waste Water,
W81-03113 3C

GROUNDWATER POLLUTION
Underground Travel of Renovated Waste Water,
W81-03113 3C

The Legal Implications of Ground Water Heat Pump Use,
W81-03148 6E

GROUNDWATER POTENTIAL
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

GROUNDWATER RESOURCES
Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

HABITATS
Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

HALOGENATED PESTICIDES
The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

HAWAII
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

HAZARDOUS MATERIALS
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

Groundwater Resources Management,
W81-03220 4B

HEAT PUMPS
The Legal Implications of Ground Water Heat Pump Use,
W81-03148 6E

HEAT TRANSFER
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

HEATING
They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

HEAVY METALS
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

HERBICIDES
Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

HILLSBOROUGH COUNTY
Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

HOGS
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

HOUSTON
Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

HUDSON BAY
Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

HUDSON RIVER
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

HUMAN DISEASES
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

HUMAN FACTORS ENGINEERING
Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

HUMIC ACIDS
Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

HYDRAULIC DESIGN
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

HYDRAULIC GRADIENT
Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

HYDROCARBON GAS TRACERS
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

HYDROCARBONS
The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

HYDROGEN ION CONCENTRATION
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

A Method for Evaluating the Acid-Base Balance in Natural Waters,
W81-03212 5A

HYDROGEOLOGY
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

HYDROGRAPHY
Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

HYDROLOGIC BUDGET
Guide Manual for Preparation of Water Balances,
W81-02971 6A

Water Budget Computation in Lake Okeechobee,
W81-03100 2D

HYDROLOGIC DATA
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

Surface-Water Data for Idaho, 1971-75.
W81-02991 7C

HYDROLOGY
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

HYDROSTATIC PRESSURE
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

HYPOLIMNION
Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

IDAHO
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

Surface-Water Data for Idaho, 1971-75.
W81-02991 7C

ILLINOIS
AWT Operating Procedures,
W81-03138 5D

IMPAIRED WATER USE
Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

INCINERATION
Toronto Turns Sludge into Energy,
W81-03112 5E

INDUSTRIAL WASTE WATER
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

INDUSTRIAL WASTES
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

Poor Sludge Settleability Caused by the Bacterium Lampropedia,
W81-03139 5D

Water Reclamation and Reuse,
W81-03174 5D

INDUSTRIAL WASTES

Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

INDUSTRIAL WATER
Flocculants for Aqueous Systems,
W81-03023 5F

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

INFILTRATION
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

Underground Travel of Renovated Waste Water,
W81-03113 3C

Monitoring for Land Application of Waste Water,
W81-03210 5E

INLAND WATERWAYS
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

INLETS
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

INORGANIC COMPOUNDS
Inorganics,
W81-03161 5A

INSECTICIDES
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

INSTITUTIONAL CONSTRAINTS
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

INVERTEBRATES
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

ION EXCHANGE
Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

ION TRANSPORT
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

IRISH SEA
Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

IRON
Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

IRON BACTERIA
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

IRON COMPOUNDS
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

IRRIGATION
Drip Level Irrigation Emitter Unit,
W81-03017 3F

Method of Watering,
W81-03027 3F

IRRIGATION EFFICIENCY
Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

IRRIGATION PERMITS
Water Law - Refusing Irrigation Waste Water on Different Lands: A Warning to Get a New Permit,
W81-03102 6E

IRRIGATION PRACTICES
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

IRRIGATION SYSTEMS
Rotary Irrigation System,
W81-03015 3F

Computer-Controlled Irrigation System,
W81-03016 3F

Drip Irrigation System,
W81-03028 3F

IRRIGATION WATER
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

ISRAEL
Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

ITALY
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

JORDAN RIVER
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

KINGS CANYON NATIONAL PARK
The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

KYNAR
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

LABORATORY EQUIPMENT
Water and Waste Process Analytical Parameters,
W81-03143 5A

LAGOONS
Lagoons and Oxidation Ponds,
W81-03166 5D

LAKE MICHIGAN
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

LAKE OKEECHOBEE
Water Budget Computation in Lake Okeechobee,
W81-03100 2D

LAKE SHORES
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

LAKE SUPERIOR
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

LAKE TEXOMA
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

LAKE TROUT
Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

LAKES
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

The Role of Fishes in the Regulation of Phosphorus Availability in Lakes,
W81-03226 2H

Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

LAND DISPOSAL
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

Land Application of Waste Water,
W81-03175 5D

Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

Monitoring for Land Application of Waste Water,
W81-03210 5E

LAND RECLAMATION
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

LAND SUBSIDENCE
Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

LAND USE
Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

LAPLACE EQUATION
A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

LARVAE
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

LEACHATES
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

LEACHING
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

LEGAL ASPECTS
Water Law - Refusing Irrigation Waste Water on Different Lands: A Warning to Get a New Permit,
W81-03102 6E

Federal Water Pollution Laws and Mining--A Summary,
W81-03108 6E

Comments to the U.S. Army Corps of Engineers Regarding Proposed Regulations on Implementing Section 404 of the Clean Water Act: A Position of the Society of American Foresters.
W81-03134 4A

LEIOSTOMUS XANTHURUS
Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

LIME
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

LIMNOLOGY
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

LINCOLN
Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

LIPIDS
Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

LITERATURE REVIEW
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

Economics,
W81-03159 6C

Law,
W81-03160 6E

Inorganics,
W81-03161 5A

Water Characteristics,
W81-03162 5B

Organics,
W81-03163 5A

Physical and Chemical Methods,
W81-03164 5D

Biological Filters,
W81-03165 5D

Lagoons and Oxidation Ponds,
W81-03166 5D

Denitrification,
W81-03168 5D

Sludge Treatment, Utilization, and Disposal,
W81-03169 5D

Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

Fermentation Industry,
W81-03181 5D

Dariy Wastes,
W81-03182 5D

Agricultural Wastes,
W81-03183 5D

Textile Wastes,
W81-03184 5D

Pulp and Paper Industry Waste Water Management,
W81-03185 5D

LITERATURE REVIEWS
Disinfection,
W81-03172 5F

LITHOLOGIC LOGS
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

LOUISIANA
Pathogenicity of Cercospora Rodmanii Conway on Eichhornia Crassipes (Mart.) Solms in Natchitoches Parish, Louisiana,
W81-02974 2I

LOUISVILLE
A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

LOXAHATCHEE RIVER BASIN
Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

MALLARD DUCK
Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

MANAGEMENT
Evolution of Management Policy and Research in the National Parks,
W81-03120 6G

MANAGEMENT PLANNING
Minority Water Awareness Program.
W81-02910 6E

MAPS
Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

MARINE AIR MASSES
The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona,
W81-03122 2B

MARINE ALGAE
Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

MARINE FUNGI
Distribution and Ecology of Marine Fungi in Sierra Leone (Tropical West Africa),
W81-03214 5B

MARSHES
Water Budget Computation in Lake Okeechobee,
W81-03100 2D

MASS TRANSFER
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

MASSACHUSETTS
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

MATHEMATICAL MODELS
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

Unsaturated Flow in an Arid Environment,
W81-02911 2F

Water Budget Computation in Lake Okeechobee,
W81-03100 2D

Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

MATHEMATICAL STUDIES
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

MEASUREMENT
Unit Water Consumption for Towns in South Africa,
W81-03233 6D

MEAT PROCESSING INDUSTRY
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

MEDITERRANEAN SEA
Mediterranean Cleanup - Nations Join Forces,
W81-03238 6E

MEMBRANE PROCESSES
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

MEMBRANES
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances.
W81-03004 3A

Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

MERCURY
Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

METALS
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

METHANE
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

METHYLMERCURY
Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

METROPOLITAN WATER MANAGEMENT
Management of Water Quality and Treatment,
W81-03219 5F

MICHIGAN
The Anatomy of an Ozone Plant,
W81-03077 5F

MICROBIOLOGICAL STUDIES
Microbiology of Waste Water Treatment,
W81-03188 5D

MICROORGANISMS
Water Purification System,
W81-02913 5G

Final Treatment,
W81-03049 5D

MIDGES
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

MINERAL WATER
Bottled Water: Expensive Groundwater,
W81-03153 5A

MINING
Environmental Issues: Still Clouded in Uncertainty,
W81-03107 5C

Federal Water Pollution Laws and Mining--A Summary,
W81-03108 6E

MINNESOTA
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

MINNESOTA RIVER WATERSHED
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

MINORITY LEADERS
Minority Water Awareness Program.
W81-02910 6E

MISSISSIPPI DELTA
Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

MODEL STUDIES
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

Unsteady Sediment Transport Law and Prediction of Aggradation Parameters,
W81-03053 2J

Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

Systems Analysis,
W81-03158 6A

The Determination of Soil-Water Desorption Curves for Soil Cores,
W81-03232 2G

MOISTURE GRADIENT
The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona,
W81-03122 2B

MONITORING
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

Monitoring for Land Application of Waste Water,
W81-03210 5E

MONTANA
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

MONTGOMERY COUNTY
Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

MORBIDITY
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

MORTALITY
Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

MOSQUITOES
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

MOUNTAIN CREEK
Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

MULTIPURPOSE RESERVOIRS
Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

MUNICIPAL WASTE WATER
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

MUNICIPAL WASTES
Albany County Sewer District, New York,
W81-03239 5D

MUNICIPAL WATER
Unit Water Consumption for Towns in South Africa,
W81-03233 6D

MUSSELS
Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

NATIONAL ACADEMY OF SCIENCES
The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead.,
W81-03141 5F

NATIONAL PARKS
Evolution of Management Policy and Research in the National Parks,
W81-03120 6G

NATURAL LEVELS
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

NATURAL RESOURCES
United States Geological Survey Yearbook, Fiscal Year 1980.
W81-02914 7C

NATURAL STREAMS
West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

NEMATODES
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

NETWORKS
Design of Precipitation Networks,
W81-03121 2B

NEVADA
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

NEW ENGLAND
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

Groundwater Resources Management,
W81-03220 4B

NEW MEXICO
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

NEW YORK
Monitoring for Land Application of Waste Water,
W81-03210 5E

Albany County Sewer District, New York,
W81-03239 5D

NEW YORK BIGHT
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

NEW ZEALAND
Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

NICKEL
Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

NITRIFICATION
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

NITRITES
Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

NITROGEN
The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters,
W81-03103 7B

NITROGEN COMPOUNDS
Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

NITROGEN CYCLE
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

NONPOINT POLLUTION SOURCES
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

NORMAN COUNTY (MN)
Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

NORTH CREEK
Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

NORTH DAKOTA
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

NORTHEASTERN MASSACHUSETTS
Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

NUCLEAR WASTES
Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

NUTRIENTS
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes.
W81-03196 2H

Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

OAK RIDGE NATIONAL LABORATORY
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

ODOR CONTROL
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

OIL
Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

OIL POLLUTION
Oil Spill Cleanup Method and Apparatus,
W81-03026 5G

OIL SHALE
Environmental Issues: Still Clouded in Uncertainty,
W81-03107 5C

OIL SPILLS
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

Oil Spill Cleanup Method and Apparatus,
W81-03026 5G

OILY WATER
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

ONTARIO
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

OPERATING POLICIES
Operational Guidelines,
W81-03050 5D

OPERATION AND MAINTENANCE
Operation and Maintenance of Waste Water Collection and Treatment Facilities,
W81-03171 5D

OPTICAL PROPERTIES
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

OPTIMIZATION
Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

OREGON
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

ORGANIC ACIDS
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

ORGANIC CARBON
Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

ORGANIC COMPOUNDS
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

Methods for Estimating the Number of Identifiable Organic Pollutants in the Aquatic Environment,
W81-03069 5A

Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

ORGANIC MATTER
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

ORGANIC WASTES
Organics,
W81-03163 5A

ORGANOCHLORINES
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

OSMOSIS
Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

OUTFALL SEWERS
Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

OUTFLOW
Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
W81-02921 7B

OXIDATION PONDS
Lagoons and Oxidation Ponds,
W81-03166 5D

OXYGEN DEPLETION
Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

OXYGENATION
Numerical Model Describing Groundwater Treatment by Recharge of Oxygenated Water,
W81-03055 5F

OYSTERS
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

OZONATION
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

Ozone Disinfection,
W81-03045 5D

The Anatomy of an Ozone Plant,
W81-03077 5F

OZONE
Ozone Disinfection,
W81-03045 5D

PACIFIC SLOPE BASINS
Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

PALM BEACH COUNTY
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

PARTICULATE MATTER
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

PATENTS
Water Purification System,
W81-02913 5G

Rotary Irrigation System,
W81-03015 3F

Computer-Controlled Irrigation System,
W81-03016 3F

Drip Level Irrigation Emitter Unit,
W81-03017 3F

Method and Apparatus for Treating Sewage,
W81-03018 5D

Microbiological Method for Removing Pathogenic Microbes and Dissolved Organic Materials from Liquids,
W81-03019 5D

Process for Biological Denitrification of Effluents,
W81-03020 5D

Process for Slow Softening Water,
W81-03021 5F

Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

Flocculants for Aqueous Systems,
W81-03023 5F

Water Treating Process,
W81-03024 5F

Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

Oil Spill Cleanup Method and Apparatus,
W81-03026 5G

Method of Watering,
W81-03027 3F

Drip Irrigation System,
W81-03028 3F

Solar Desalination System,
W81-03029 3A

Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

Water Conditioner Rotary Value Structure,
W81-03032 5D

Remote Control Valve for Reverse Osmosis Water Purifier,
W81-03033 5F

Multiple Stage Jet Nozzle and Aeration System,
W81-03034 5D

Magnetic Treatment Devices for Water Pipelines,
W81-03035 5G

Water Screen,
W81-03036 5G

Dredging Vessel,
W81-03154 8A

PATH OF POLLUTANTS

Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

PATHOGENS

Pathogenicity of Cercospora Rodmanii Conway on Eichhornia Crassipes (Mart.) Solms in Natchitoches Parish, Louisiana,
W81-02974 2I

PERCOLATION

The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

PERFORMANCE EVALUATION

Treatment Improved through Process Control,
W81-03142 5D

Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

PESTICIDE RESIDUES

Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

PESTICIDE TOXICITY

Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

PESTICIDES

Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

PHENOLS

The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column,
W81-03097 5F

Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

PHILADELPHIA

Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

PHOSPHATES

Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

PHOSPHORUS

The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters,
W81-03103 7B

PHOSPHORUS COMPOUNDS

Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

The Role of Fishes in the Regulation of Phosphorus Availability in Lakes,
W81-03226 2H

PHOSPHORUS REMOVAL

Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

PHYTOPLANKTON

Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

PIEZOELECTRIC

Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

PIPELINES

Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

PIPES

Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

PLANNING

Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

PLANT DISEASES

Pathogenicity of Cercospora Rodmanii Conway on Eichhornia Crassipes (Mart.) Solms in Natchitoches Parish, Louisiana,
W81-02974 2I

PLANT PHYSIOLOGY

The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

Daily Fluctuations in Water Potential and Associated Ionic Changes in Atriplex Canescens,
W81-03250 2D

PLATING INDUSTRY

Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

PLUTONIUM

Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

POISSON DISTRIBUTION

Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

POLLUTANT IDENTIFICATION

High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

Water and Waste Process Analytical Parameters,
W81-03143 5A

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

POLLUTANTS
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

POLY (VINYLIDENE FLUORIDE)
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

POLYCHLORINATED BIPHENYLS
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

POLYCYCLIC AROMATIC HYDROCARBONS
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

POLYMERS
A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

POROUS MEDIA
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

POTABLE WATER
Alaska Village Demonstration Projects, Final Report,
W81-02944 5D

Health Aspects,
W81-03051 5D

Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

Disease Outbreaks Caused by Drinking Water,
W81-03186 5C

How to Cope with the SDWA/II,
W81-03209 7C

POTENTIAL WATER SUPPLY
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

POWERPLANTS
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

PRECIPITATION (ATMOSPHERIC)
Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

Design of Precipitation Networks,
W81-03121 2B

The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona,
W81-03122 2B

PREIMPOUNDMENT
Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

PRESSURE HEAD
Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

PRETREATMENT OF WATER
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

PRIMARY PRODUCTION
Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

PRIMARY PRODUCTIVITY
Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

PROCESS CONTROL
Treatment Improved through Process Control,
W81-03142 5D

PRODUCTIVITY
Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

PROJECT PLANNING
The EPA Value Engineering Program. Part 1: What it is and What it does,
W81-03081 6B

PROTOZOA
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

PUBLIC HEALTH
Alaska Village Demonstration Projects, Final Report,
W81-02944 5D

Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

Watershed Management,
W81-03221 5G

PULP AND PAPER INDUSTRY
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

Pulp and Paper Industry Waste Water Management,
W81-03185 5D

PULP WASTES
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

PUMPAGE
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

PUMPING TESTS
Pumping Test Analyses for Low Yield Formations,
W81-03229 7B

QUALITY CONTROL
AWT Operating Procedures,
W81-03138 5D

RADIOACTIVE WASTE DISPOSAL
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

RADIUM RADIOISOTOPES
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

RAIN GAGES
Design of Precipitation Networks,
W81-03121 2B

RAINFALL
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation,
W81-03063 2B

Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

RAINFALL-RUNOFF RELATIONSHIPS
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

RAINWATER
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

RANGE ANALYSIS
Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

REAERATION COEFFICIENT
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

RECARBONATION
Softening and Recarbonation,
W81-03042 5D

RECHARGE WELLS
Numerical Model Describing Groundwater Treatment by Recharge of Oxygenated Water,
W81-03055 5F

RECLAIMED WATER
Underground Travel of Renovated Waste Water,
W81-03113 3C

Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

RECREATION FACILITIES
Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

RECYCLING
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

REGENERATION
Carbon Regeneration,
W81-03048 5D

REGIONAL DEVELOPMENT
The Case for Regional Groundwater Management,
W81-03132 6B

REGIONAL ECONOMICS
Economic Analysis of Rural Sludge Management,
W81-02933 5E

REGIONAL PLANNING
Minority Water Awareness Program.
W81-02910 6E

REGULATIONS
The Legal Implications of Ground Water Heat Pump Use.
W81-03148 6E

REHABILITATION
Restoring Wells Is No Gamble in Las Vegas,
W81-03230 3B

REMOTE SENSING
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

RESEARCH NEEDS
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

RESERVOIR CAPACITY
Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

RESERVOIR OPERATION
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

RESERVOIR RELEASES
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

RESERVOIR SILTING
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin,
W81-02912 2J

RESERVOIR STORAGE
Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

RESERVOIRS
Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

RESISTIVITY
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

RESOURCES MANAGEMENT
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

RETAINING WALLS
Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

REVERSE OSMOSIS
Remote Control Valve for Reverse Osmosis Water Purifier,
W81-03033 5F

REVIEWS
United States Geological Survey Yearbook, Fiscal Year 1980.
W81-02914 7C

Systems Analysis,
W81-03158 6A

Anaerobic Processes,
W81-03167 5G

On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

Operation and Maintenance of Waste Water Collection and Treatment Facilities,
W81-03171 5D

Wastewater Collection,
W81-03173 5D

Water Reclamation and Reuse,
W81-03174 5D

Disease Outbreaks Caused by Drinking Water,
W81-03186 5C

Microbiology - Detection, Occurrence, and Removal of Viruses,
W81-03187 5G

Microbiology of Waste Water Treatment,
W81-03188 5D

RHINE RIVER
Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

RIPARIAN VEGETATION
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

RIVER BASINS
Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

RIVERS
Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

ROCK PROPERTIES
Flow Through Fractures,
W81-03064 2F

RUNOFF
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

RURAL AREAS
Economic Analysis of Rural Sludge Management,
W81-02933 5E

Alaska Village Demonstration Projects, Final Report,
W81-02944 5D

RURAL SLUDGE MANAGEMENT COSTS
Economic Analysis of Rural Sludge Management,
W81-02933 5E

RUSSIA
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

SAFE DRINKING WATER ACT
How to Cope with the SDWA/II,
W81-03209 7C

SALINE-FRESHWATER INTERFACES
Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

SALINE WATER
Vertical Tube Foam Evaporation Applied for *Heat Transfer Enhancement in a Commercial* Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

SALINITY
Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bulifrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Salinity and Production of Food Crops: A Problem *from Antiquity, A Challenge for the Future,*
W81-03006 3C

SALT MARSHES
Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

SALT TOLERANCE
Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

SAMPLING
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

SAND
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

SANDS
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

SANITARY LANDFILLS
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

SANTA FE
Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

SCALING
Water Treating Process,
W81-03024 5F

Final Treatment,
W81-03049 5D

SCREENS
Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

SEA WATER
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

SEAWATER
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere,
W81-03104 5A

Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

SEDIMENT CONTROL
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

Dredging Vessel,
W81-03154 8A

SEDIMENT DISCHARGE
Measurement and Computation of Bed-Material *Discharge in a Shallow Sand-Bed Stream,* Muddy Creek, Wyoming,
W81-03060 2J

SEDIMENT TRANSPORT
Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

Unsteady Sediment Transport Law and Prediction of Aggradation Parameters,
W81-03053 2J

SEDIMENT YIELD
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin,
W81-02912 2J

Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

SEDIMENTATION RATES
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

SEDIMENTS
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

SEEPAGE
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

SEISMIC WAVES
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

SELF-PURIFICATION
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

SENSITIVITY ANALYSIS
Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

SEPARATION TECHNIQUES
Process for Slow Softening Water,
W81-03021 5F

Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

SEPTIC TANKS
On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

SETTLEABLE SOLIDS
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

SETTLING BASINS
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

SEWAGE TREATMENT
Method and Apparatus for Treating Sewage,
W81-03018 5D

Microbiological Method for Removing Pathogenic Microbes and Dissolved Organic Materials from Liquids,
W81-03019 5D

Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

SEWER SYSTEMS
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

SHAGAWA LAKE
Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

SHELLFISH
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

SHORE PROTECTION
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

SIMULATION ANALYSIS
Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

SIPHONS
Feasibility of Siphons for Degassing Water,
W81-03248 8I

SLUDGE
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

SLUDGE DISPOSAL
Economic Analysis of Rural Sludge Management,
W81-02933 5E

Toronto Turns Sludge into Energy,
W81-03112 5E

Sludge Treatment, Utilization, and Disposal,
W81-03169 5D

SLUDGE DRYING
Sludge Dewatering,
W81-03047 5D

A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

SLUDGE THICKENING
Sludge Dewatering,
W81-03047 5D

SLUDGE TREATMENT
Toronto Turns Sludge into Energy,
W81-03112 5E

Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

SMELTERS
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

SNAKE RIVER
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

SNOWMELT
The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

SOCIAL ASPECTS
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

SODIUM CHLORIDE
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere,
W81-03104 5A

SOIL CHEMISTRY
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

SOIL CONTAMINATION
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

SOIL DISPOSAL FIELDS
On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

SOIL ENVIRONMENT
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

SOIL MOISTURE
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

SOIL MOISTURE MOVEMENT
Comment on 'Analysis of Water and Heat Flow in Unsaturated-Saturated Porous Media' by Marios Sophocleous,
W81-03085 2G

SOIL MOISTURE RETENTION
The Determination of Soil-Water Desorption Curves for Soil Cores,
W81-03232 2G

SOIL PHYSICAL PROPERTIES
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

SOIL PHYSICS
A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

SOIL WATER
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

SOIL WATER MOVEMENT
A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

SOIL-WATER-PLANT RELATIONSHIPS
Daily Fluctuations in Water Potential and Associated Ionic Changes in Atriplex Canescens,
W81-03250 2D

SOLAR DISTILLATION
Solar Desalination System,
W81-03029 3A

SOLID WASTE DISPOSAL
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

SOLUBILITY
The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

SOLUTIONS
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere,
W81-03104 5A

SONG BIRDS
Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

SOUTH AFRICA
Manual for Water Renovation and Reclamation.
W81-03037 5D

An Introduction to Water Renovation and Reclamation,
W81-03038 5D

Clarification,
W81-03039 5D

Quality Equalization,
W81-03040 5D

Ammonia Stripping,
W81-03041 5D

Softening and Recarbonation,
W81-03042 5D

Filtration,
W81-03043 5D

Chlorine Disinfection,
W81-03044 5D

Ozone Disinfection,
W81-03045 5D

Active Carbon Adsorption,
W81-03046 5D

Sludge Dewatering,
W81-03047 5D

Carbon Regeneration,
W81-03048 5D

Final Treatment,
W81-03049 5D

Operational Guidelines,
W81-03050 5D

Health Aspects,
W81-03051 5D

Unit Water Consumption for Towns in South Africa,
W81-03233 6D

SOUTH DAKOTA
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

SOUTHERN CALIFORNIA
Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

SPAIN
Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total

de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

SPECTROPHOTOMETRY
Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

SPILLWAYS
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

SPRAY IRRIGATION
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

SPRINKLER IRRIGATION
Rotary Irrigation System,
W81-03015 3F

Method of Watering,
W81-03027 3F

ST. LOUIS AREA
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

STANDARDS
Manual for Water Renovation and Reclamation.
W81-03037 5D

The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead.,
W81-03141 5F

STATISTICAL METHODS
Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

STOCHASTIC PROCESSES
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation,
W81-03063 2B

STORAGE RESERVOIRS
A Review of Water Quality Problems Caused by Various Open Distribution Storage Reservoirs,
W81-03218 5B

STORM RUNOFF
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization.
W81-03157 5A

STORM WATER
Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

STREAMFLOW
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
W81-02921 7B

Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

STREAMS
Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

Measurement and Computation of Bed-Material Discharge in a Shallow Sand-Bed Stream, Muddy Creek, Wyoming,
W81-03060 2J

Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

STRIP MINE WASTES
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

Environmental Effects of Western Coal Surface Mining. Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

SUBSURFACE RUNOFF
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

SULFATES
Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

SULFIDES
Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

SUMTER COUNTY
Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

SUPERSATURATION
Etiology of Gas Bubble Disease,
W81-03241 5C

Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

Feasibility of Siphons for Degassing Water,
W81-03248 8I

SURFACE-GROUNDWATER RELATIONS
Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

SURFACE WATER
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

SURFACE WATERS
Surface-Water Data for Idaho, 1971-75.
W81-02991 7C

SURVIVAL
Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

SUWANNEE RIVER BASIN
Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

SWEDEN
Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

SWIMMING
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

SWIMMING POOLS
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

SYNTHETIC FUELS
Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

SYSTEMS ANALYSIS
Systems Analysis,
W81-03158 6A

TALLAHATCHIE RIVER
Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

TANNERY WASTES
Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

TAXONOMY
Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

TELEOSTS
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

TELLURIDE
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

TEMPERATURE
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation,
W81-03063 2B

Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

TENNESSEE
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

TERATOGENESIS
Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

TESTING PROCEDURES
Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

TEXAS BARRIER ISLANDS REGION
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

TEXTILE MILL WASTES
Textile Wastes,
W81-03184 5D

TEXTILES
Principles of Dye Removal from Textile Effluent,
W81-03249 5D

THEORETICAL ANALYSIS
Unsaturated Flow in an Arid Environment,
W81-02911 2F

THERMAL DISCHARGES
The Legal Implications of Ground Water Heat Pump Use,
W81-03148 6E

THERMAL POLLUTION
Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

THERMAL POWERPLANTS
Surface Containment for Geothermal Brines,
W81-02955 5G

THERMAL SPRINGS
Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

THERMAL STRATIFICATION
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

THERMAL WATER
Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

THERMODYNAMICS
Unsaturated Flow in an Arid Environment,
W81-02911 2F

TIDAL EFFECTS
Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

TONGUE RIVER RESERVOIR
Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

TORONTO
Toronto Turns Sludge into Energy,
W81-03112 5E

TOXAPHENE
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

TOXICITY
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

TRACE METALS
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

TRACERS
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

TRANSMISSIVITY
Pumping Test Analyses for Low Yield Formations,
W81-03229 7B

TRAVELING WAVE SOLUTION
A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

TRICKLE IRRIGATION
Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

TRINITY RIVER BASIN
Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

TRINITY RIVER BASIN

Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

TRITIUM
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

TROPHIC LEVEL
Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

TROPICAL REGIONS
Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

TROUT
Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

TUNNEL CONSTRUCTION
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

U.S. GEOLOGICAL SURVEY ACTIVITIES
United States Geological Survey Yearbook, Fiscal Year 1980.
W81-02914 7C

ULTRAFILTRATION
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

ULTRAVIOLET RADIATION
Water Purification System,
W81-02913 5G

UNITED KINGDOM
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

UNSATURATED FLOW
Unsaturated Flow in an Arid Environment,
W81-02911 2F

URANIUM MINING
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

URANIUM RADIOISOTOPES
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

URBAN DRAINAGE
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

URBAN HYDROLOGY
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

URBAN RUNOFF
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

URBANIZATION
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

USER CHARGES
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

VAPOR COMPRESSION DISTILLATION
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

VENEZUELA
Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

VIRGINIA
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

VIRUSES
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

Microbiology - Detection, Occurrence, and Removal of Viruses,
W81-03187 5G

WASHINGTON
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

WASTE DISPOSAL
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

WASTE DUMPS
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

WASTE STORAGE
Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

WASTE TREATMENT
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

WASTE WATER COLLECTION
Wastewater Collection,
W81-03173 5D

Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

WASTE WATER COMPOSITION
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

WASTE WATER DISPOSAL
On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

WASTE WATER FACILITIES
The EPA Value Engineering Program. Part I: What it is and What it does,
W81-03081 6B

The EPA Value Engineering Program: Part II,
W81-03082 6A

WASTE WATER FARMING
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

WASTE WATER IRRIGATION
Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

WASTE WATER MANAGEMENT
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

Pulp and Paper Industry Waste Water Management,
W81-03185 5D

WASTE WATER OXIDATION
Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

WASTE WATER RENOVATION
Manual for Water Renovation and Reclamation.
W81-03037 5D

An Igtroduction to Water Renovation and Reclamation,
W81-03038 5D

Clarification,
W81-03039 5D

WASTE WATER TREATMENT

Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

Alaska Village Demonstration Projects, Final Report,
W81-02944 5D

Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

Method and Apparatus for Treating Sewage,
W81-03018 5D

Microbiological Method for Removing Pathogenic Microbes and Dissolved Organic Materials from Liquids,
W81-03019 5D

Process for Biological Denitrification of Effluents,
W81-03020 5D

Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

Multiple Stage Jet Nozzle and Aeration System,
W81-03034 5D

Clarification,
W81-03039 5D

Quality Equalization,
W81-03040 5D

Ammonia Stripping,
W81-03041 5D

Filtration,
W81-03043 5D

Chlorine Disinfection,
W81-03044 5D

Sludge Dewatering,
W81-03047 5D

Water Reuse: Projecting Markets and Costs,
W81-03072 3C

Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

AWT Operating Procedures,
W81-03138 5D

Poor Sludge Settleability Caused by the Bacterium Lampropedia,
W81-03139 5D

Treatment Improved through Process Control,
W81-03142 5D

Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

Physical and Chemical Methods,
W81-03164 5D

Biological Filters,
W81-03165 5D

Sludge Treatment, Utilization, and Disposal,
W81-03169 5D

On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

Operation and Maintenance of Waste Water Collection and Treatment Facilities,
W81-03171 5D

Wastewater Collection,
W81-03173 5D

Water Reclamation and Reuse,
W81-03174 5D

Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

Fermentation Industry,
W81-03181 5D

Dariy Wastes,
W81-03182 5D

Agricultural Wastes,
W81-03183 5D

Textile Wastes,
W81-03184 5D

Microbiology - Detection, Occurrence, and Removal of Viruses,
W81-03187 5G

Microbiology of Waste Water Treatment,
W81-03188 5D

Guide to Comparative Treatment Mode Efficiencies,
W81-03190 5D

Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

Albany County Sewer District, New York,
W81-03239 5D

Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

Gas-Liquid Dissolution in Waste Water Treatment,
W81-03247 5D

Principles of Dye Removal from Textile Effluent,
W81-03249 5D

WASTEWATER TREATMENT

Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

WATER ANALYSIS

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

Water and Waste Process Analytical Parameters,
W81-03143 5A

Water Characteristics,
W81-03162 5B

Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

How to Cope with the SDWA/II,
W81-03209 7C

A Method for Evaluating the Acid-Base Balance in Natural Waters,
W81-03212 5A

WATER BALANCE
Guide Manual for Preparation of Water Balances,
W81-02971 6A

WATER CONSERVATION
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

An Introduction to Water Renovation and Reclamation,
W81-03038 5D

Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing,
W81-03073 3D

WATER CONSUMPTION
Unit Water Consumption for Towns in South Africa,
W81-03233 6D

WATER CONTROL
Comments to the U.S. Army Corps of Engineers Regarding Proposed Regulations on Implementing Section 404 of the Clean Water Act: A Position of the Society of American Foresters.
W81-03134 4A

WATER CONVEYANCE
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

WATER DEMAND
Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

WATER HYACINTH
Pathogenicity of Cercospora Rodmanii Conway on Eichhornia Crassipes (Mart.) Solms in Natchitoches Parish, Louisiana,
W81-02974 2I

Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

WATER LAW
Federal Water Pollution Laws and Mining--A Summary,
W81-03108 6E

Law,
W81-03160 6E

WATER LEVEL
Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

WATER LEVEL FLUCTUATIONS
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

WATER LEVELS
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

WATER MANAGEMENT
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing,
W81-03073 3D

Systems Analysis,
W81-03158 6A

WATER MANAGEMENT (APPLIED)
Water Reuse: Projecting Markets and Costs,
W81-03072 3C

The Case for Regional Groundwater Management,
W81-03132 6B

WATER POLICY
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

Minority Water Awareness Program.
W81-02910 6E

Evolution of Management Policy and Research in the National Parks,
W81-03120 6G

WATER POLLUTION
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

WATER POLLUTION CONTROL
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

Water Screen,
W81-03036 5G

Federal Water Pollution Laws and Mining--A Summary,
W81-03108 6E

Microbiology - Detection, Occurrence, and Removal of Viruses,
W81-03187 5G

WATER POLLUTION EFFECTS
Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

Report on Health and Environmental Effects of Increased Coal Utilization, by the Committee on Health and Environmental Effects of Increased Coal Utilization.
W81-03217 5C

The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

WATER POLLUTION PREVENTION
Surface Containment for Geothermal Brines,
W81-02955 5G

Mediterranean Cleanup - Nations Join Forces,
W81-03238 6E

WATER POLLUTION SOURCES
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

A Review of Water Quality Problems Caused by Various Open Distribution Storage Reservoirs,
W81-03218 5B

WATER POLLUTION TREATMENT
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

Method and Apparatus for Treating Sewage,
W81-03018 5D

Microbiological Method for Removing Pathogenic Microbes and Dissolved Organic Materials from Liquids,
W81-03019 5D

Process for Biological Denitrification of Effluents,
W81-03020 5D

Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

Feasibility of Siphons for Degassing Water,
W81-03248 8I

WATER PROPERTIES
Water Characteristics,
W81-03162 5B

WATER PURIFICATION
Water Purification System,
W81-02913 5G

Remote Control Valve for Reverse Osmosis Water Purifier,
W81-03033 5F

Disinfection,
W81-03172 5F

WATER QUALITY
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

Water Resources Data for California, Water Year 1979--Volume 1. Colorado River Basin, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River.
W81-02928 7C

Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

Quality Equalization,
W81-03040 5D

Health Aspects,
W81-03051 5D

The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

Water and Waste Process Analytical Parameters,
W81-03143 5A

Economics,
W81-03159 6C

Law,
W81-03160 6E

WATER QUALITY CONTROL
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

Water Screen,
W81-03036 5G

Softening and Recarbonation,
W81-03042 5D

Active Carbon Adsorption,
W81-03046 5D

A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

The Anatomy of an Ozone Plant,
W81-03077 5F

Evaluating Costs and Benefits of Alternative Disinfectants,
W81-03078 5F

Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

Systems Analysis,
W81-03158 6A

Mediterranean Cleanup - Nations Join Forces,
W81-03238 6E

WATER RECLAMATION
Manual for Water Renovation and Reclamation.
W81-03037 5D

Health Aspects,
W81-03051 5D

WATER RENOVATION
Quality Equalization,
W81-03040 5D

Ammonia Stripping,
W81-03041 5D

Softening and Recarbonation,
W81-03042 5D

Filtration,
W81-03043 5D

Chlorine Disinfection,
W81-03044 5D

Ozone Disinfection,
W81-03045 5D

Active Carbon Adsorption,
W81-03046 5D

Sludge Dewatering,
W81-03047 5D

Carbon Regeneration,
W81-03048 5D

Operational Guidelines,
W81-03050 5D

Health Aspects,
W81-03051 5D

WATER RESOURCES DEVELOPMENT
Guide Manual for Preparation of Water Balances,
W81-02971 6A

Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

WATER REUSE
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

Manual for Water Renovation and Reclamation.
W81-03037 5D

An Introduction to Water Renovation and Reclamation,
W81-03038 5D

Water Reuse: Projecting Markets and Costs,
W81-03072 3C

Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

Water Law - Refusing Irrigation Waste Water on Different Lands: A Warning to Get a New Permit,
W81-03102 6E

Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

Water Reclamation and Reuse,
W81-03174 5D

Land Application of Waste Water,
W81-03175 5D

WATER RIGHTS
Water Law - Refusing Irrigation Waste Water on Different Lands: A Warning to Get a New Permit,
W81-03102 6E

WATER SAMPLING
Cost Effective Stream and Effluent Monitoring, W81-02901 5A

WATER SOFTENING
Process for Slow Softening Water, W81-03021 5F

Water Conditioner Rotary Value Structure, W81-03032 5D

Softening and Recarbonation, W81-03042 5D

WATER SPREADING
Underground Travel of Renovated Waste Water, W81-03113 3C

WATER STORAGE
Range Analysis of Exchangeable Normal Variables, W81-03067 4A

WATER SUPPLY
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California, W81-02915 4B

Alaska Village Demonstration Projects, Final Report, W81-02944 5D

Guide Manual for Preparation of Water Balances, W81-02971 6A

Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems, W81-03013 5A

Management of Water Quality and Treatment, W81-03219 5F

WATER SUPPLY DEVELOPMENT
Chandler's Systems Staying on Top of Growing Needs, W81-03140 6D

WATER TREATMENT
Water Purification System, W81-02913 5G

Water Treatment Project: Observations on Use of GAC in Practice, W81-02966 5F

Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances. W81-03004 3A

Organic Pollutants in Ground-Recharged Water, W81-03008 5A

Process for Slow Softening Water, W81-03021 5F

Flocculants for Aqueous Systems, W81-03023 5F

Water Treating Process, W81-03024 5F

Solar Desalination System, W8'-03029 3A

Water Conditioner Rotary Value Structure, W81-03032 5D

Remote Control Valve for Reverse Osmosis Water Purifier, W81-03033 5F

Magnetic Treatment Devices for Water Pipelines, W81-03035 5G

Filtration, W81-03043 5D

Ozone Disinfection, W81-03045 5D

Active Carbon Adsorption, W81-03046 5D

Final Treatment, W81-03049 5D

Numerical Model Describing Groundwater Treatment by Recharge of Oxygenated Water, W81-03055 5F

A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes, W81-03074 5F

Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants, W81-03075 5F

Experience with Chloramines as Primary Disinfectants, W81-03076 5F

The Anatomy of an Ozone Plant, W81-03077 5F

Evaluating Costs and Benefits of Alternative Disinfectants, W81-03078 5F

Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models, W81-03079 5F

Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon, W81-03086 5F

Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction, W81-03087 5A

Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column, W81-03097 5F

The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead., W81-03141 5F

Disinfection, W81-03172 5F

Management of Water Quality and Treatment, W81-03219 5F

WATER TREATMENT FACILITIES
Operational Guidelines, W81-03050 5D

Guide to Comparative Treatment Mode Efficiencies, W81-03190 5D

Albany County Sewer District, New York, W81-03239 5D

WATER USE
Guide Manual for Preparation of Water Balances, W81-02971 6A

WATER WELLS
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979, W81-02989 5E

Groundwater Is Best for Hatchery Fish, W81-03228 8I

Restoring Wells Is No Gamble in Las Vegas, W81-03230 3B

WATER YIELD
Pumping Test Analyses for Low Yield Formations, W81-03229 7B

WATER YIELD IMPROVEMENT
Restoring Wells Is No Gamble in Las Vegas, W81-03230 3B

WATERSHED MANAGEMENT
Watershed Management, W81-03221 5G

WATERSHEDS
Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976, W81-02920 7C

Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida, W81-03000 7C

Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries, W81-03083 5B

WEATHER DATA
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation, W81-03063 2B

WEATHER FORECASTING
The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona, W81-03122 2B

WELLS
Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston, W81-02918 7C

WEST VIRGINIA
West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia), W81-02985 2E

WETLANDS
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota, W81-02919 7C

Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions, W81-02939 2I

WHITE RIVER RESERVOIR
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin, W81-02912 2J

WILD RICE RIVER (MN)
Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota, W81-02931 5C

WILLIAMSON RIVER
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus, W81-03099 7B

WISCONSIN
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin, W81-02912 2J

Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

WITHDRAWAL
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

WORMS
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

WYOMING
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

Measurement and Computation of Bed-Material Discharge in a Shallow Sand-Bed Stream, Muddy Creek, Wyoming,
W81-03060 2J

ZOOPLANKTON
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

AUTHOR INDEX

ADRIAN, D. D.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

AHL, T.
Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

AHUJA, L. R.
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

ALBERS, P. H.
Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

ALEEM, A. A.
Distribution and Ecology of Marine Fungi in Sierra Leone (Tropical West Africa),
W81-03214 5B

ALLEN, C. I.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

AMUNDSEN, D.
Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

ANDERSON, C. L.
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet,
W81-02963 8B

ANDERSON, J. L.
Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

ANDERSON, J. T.
Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

ANDERTON, R. L.
Water Reuse: Projecting Markets and Costs,
W81-03072 3C

ANDREWS, E. D.
Measurement and Computation of Bed-Material Discharge in a Shallow Sand-Bed Stream, Muddy Creek, Wyoming,
W81-03060 2J

ANDREWS, R. M.
Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

ARBHABHIRAMA, A.
Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

ARNOLD, D. E.
Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

ARNOLD, V. L.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

AROZARENA, M. M.
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

ARUESTE, G.
Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

ASMUSSEN, L. E.
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

ASTL, J.
Remote Control Valve for Reverse Osmosis Water Purifier,
W81-03033 5F

ASTON, S. R.
Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

AULENBACH, D. B.
Monitoring for Land Application of Waste Water,
W81-03210 5E

AVNIMELECH, Y.
Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

BABCOCK, R. H.
Water and Waste Process Analytical Parameters,
W81-03143 5A

BADOUR, S. S.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

BAILEY, D. G.
Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

BAIN, R.
Bottled Water: Expensive Groundwater,
W81-03153 5A

BAKER, F. D.
Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

BAKER, R. J.
Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

BANERJI, S. K.
Guide to Comparative Treatment Mode Efficiencies,
W81-03190 5D

BARASH, S.
Computer-Controlled Irrigation System,
W81-03016 3F

BAROVIC, G.
Numerical Model Describing Groundwater Treatment by Recharge of Oxygenated Water,
W81-03055 5F

BARROW, R. L.
Treatment Improved through Process Control,
W81-03142 5D

BARTLETT, J.
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

BASHIR, W. A.
Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

BASHKIN, V. N.
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

BATTEN, W. G.
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin,
W81-02912 2J

BEATTY, J. S.
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

BECKER, C. D.
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

BECKER, L. D.
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

BEDNAR, R. E.
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

BEN AIM, R.
Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

BENJAMIN, P. M.
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

BENNETT, O. L.
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

BENZINGER, W. D.
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

BERLENBACK, N.
Process for Slow Softening Water,
W81-03021 5F

BERNARDIN, F. E.
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

BEST, G. A.
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

BEVERIDGE, A.
Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

BICKELHAUPT, D. H.
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

BIDLEMAN, T. F.
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

BILBY, R. E.
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

BINKLEY, J.
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

BLADES-FILLMORE, L. A.
The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

BOETTCHER, A. J.
Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

BOHN, H.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

BOOCHS, P. W.
Numerical Model Describing Groundwater Treatment by Recharge of Oxygenated Water,
W81-03055 5F

BOPP, R. F.
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

BOUCK, G. R.
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

Etiology of Gas Bubble Disease,
W81-03241 5C

BOUDOU, A.
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

BOYLE, W. C.
On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

BRAATEN, D.
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

BRANDMAN, Y.
Computer-Controlled Irrigation System,
W81-03016 3F

BRANDVOLD, D. K.
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

BRANDVOLD, L.
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

BRAS, R. L.
Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

BRENNER, I. S.
The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona,
W81-03122 2B

BRODERIUS, S. J.
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

BROOKES, B. I.
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

BROSSET, C.
A Method for Evaluating the Acid-Base Balance in Natural Waters,
W81-03212 5A

BROWN, D. S.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

BUESCHER, C. A.
The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead.,
W81-03141 5F

BURNET, A. M. R.
Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

BURNETT, L. E.
Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

BUTLER, D. L.
Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

BUTLER, K. S.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

BYRNE, R. J.
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

CABANE, B.
Process for Biological Denitrification of Effluents,
W81-03020 5D

CAIN, D. J.
The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

CARGO, P.
They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

CARLSON, A. J.
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

CARPENTER, P. J.
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

CARR, M. R.
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

CARRILLO, E. R.
Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

CARROLL, J. H.
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

CARVER, C. E.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

CARY, S. J.
Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

CASE, C. M.
Unsaturated Flow in an Arid Environment,
W81-02911 2F

CHALIFOUX, C.
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

CHAMBON, P.
Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

CHANG, C. H.
Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column,
W81-03097 5F

CHANG, P. W.
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

CHAPMAN, G. A.
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

CHARLTON, M. N.
Hypolimnion Oxygen Consumption in Lakes: Discussion of Productivity and Morphometry Effects,
W81-03224 2H

CHATTERJEE, S.
Wastewater Collection,
W81-03173 5D

CHEN, C-S.
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

CHESNEY, D. J.
Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

CHIAN, E. S. K.
Organics,
W81-03163 5A

CHRISTENSEN, E. C.
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

CHU, T-Y. J.
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

CHUNG, L. T. K.
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

CHURCHILL, D. H.
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

CHYNOWETH, D. P.
Anaerobic Processes,
W81-03167 5G

CIBIK, C.
Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

CIOLKOSZ, E. J.
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

CISSELL, J. A.
Land Application of Waste Water,
W81-03175 5D

CLARK, R. M.
Evaluating Costs and Benefits of Alternative Disinfectants,
W81-03078 5F

CLARK, R. R.
Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

CLARKE, A.
Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

CLARKSON, C. C.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

CLARKSON, W. W.
Agricultural Wastes,
W81-03183 5D

CLESCERI, N. L.
Monitoring for Land Application of Waste Water,
W81-03210 5E

COATES, J. A.
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

COFFIN, J. E.
Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

COHEN, Y.
Computer-Controlled Irrigation System,
W81-03016 3F

COLEMAN, W. E.
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

COLLINS, E. R. JR.
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

CONNOR, J. L.
Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

COOLEY, T. N.
Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

COOPER, D. E.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

CORDOVA, J. R.
Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

COUCH, J. A.
Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

COURTOT-COUPEZ, J.
Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

COVIELLO, A. J.
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

COX, L. C.
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

COX, W. E.
Law,
W81-03160 6E

CRAUN, G. F.
Disease Outbreaks Caused by Drinking Water,
W81-03186 5C

CRIST, M. A.
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

CRONCE, R. C.
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

CROSBY, N. T.
Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

CUMMINS, M. D.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

CUNNINGHAM, J.
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

CURRAN, S. J.
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

CUSTER, T. W.
Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

D'ALESSIO, D. J.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

D'AOUST, B.
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

DALELA, R. C.
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

DALPRA, C.
Mediterranean Cleanup - Nations Join Forces,
W81-03238 6E

DASILVA, P.
Toronto Turns Sludge into Energy,
W81-03112 5E

DAVIS, J.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

DAVIS, J. M.
Primary Production in Lakes Rotorua, Rerewhakaaitu, and Rotoiti, North Island, New Zealand, 1973-78,
W81-03222 2H

DAVIS, M. E.
Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

DAWLEY, E. M.
Feasibility of Siphons for Degassing Water,
W81-03248 8I

DAWSON, G. W.
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

DEARBORN, L. L.
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

DEFAZIO, C. D.
Albany County Sewer District, New York,
W81-03239 5D

DEFRAITES, A. A.
Method and Apparatus for Treating Sewage,
W81-03018 5D

DELANEY, D. F.
Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

DELARCHE, A.
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

DELLEUR, J. W.
Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

DENCE, C. W.
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

DENN, M. M.
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

DEVERA, E. R.
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

DEWALLE, F. B.
Organics,
W81-03163 5A

DIETER, M. P.
Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

DILOUIE, J. M.
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

DORSEY, M. E.
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

DROST, B. W.
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

DRURY, D. D.
Operation and Maintenance of Waste Water Collection and Treatment Facilities,
W81-03171 5D

DUNN, S. J.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

DURAND, A.
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

DURKIN, P. R.
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

DUTKA, B. J.
Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

DYMOND, V. J.
Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

DYSART, J. E.
Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

EBEL, W. J.
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

EGANHOUSE, R. P.
Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

EL-SHAARAWI, A. H.
Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

ELLIS, D. H.
Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

ELMALEH, S.
Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

ERICSON, D. W.
Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

ERMAN, D. C.
The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

ESPARAZA, A.
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

ESTERBY, S. R.
Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

ETZEL, J. E.
Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

EVANS, T. M.
Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

FANNIN, K. F.
Anaerobic Processes,
W81-03167 5G

FARMER, H.
The EPA Value Engineering Program. Part I: What it is and What it does,
W81-03081 6B

The EPA Value Engineering Program: Part II,
W81-03082 6A

FEIND, T.
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

FERREIRA, R. F.
Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

FIELD, R.
Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

FISAC HERRERO, J.
Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

FISCHER, J. N.
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

FLAMANG, M. A.
A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

FLAMERZ, S.
Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

FLATOW, R. E.
Water Purification System,
W81-02913 5G

FLETCHER, G. C.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

FLUKE, D. J.
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

FORD, G. H.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

FRANKEL, I.
Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

FRINK, M. E.
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

FRITZ, R. G.
Economic Analysis of Rural Sludge Management,
W81-02933 5E

FRITZ, S. J.
Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

FULLER, D. B.
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

FULLER, K. B.
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

FUTOMA, D. J.
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

GALLOWAY, J. N.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

GARDNER, B. D.
The Case for Regional Groundwater Management,
W81-03132 6B

GARLAND, J. A.
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

GARNER-PRICE, S.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

GARTON, R. R.
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

GATZ, D. F.
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

GAY, F. B.
Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

GEORGE, D. B.
Lagoons and Oxidation Ponds,
W81-03166 5D

GERHART, D. Z.
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

GERRATH, J.
Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

GHOSH, S.
Anaerobic Processes,
W81-03167 5G

GILLESPIE, P. A.
Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

GIOVANNELLI, R. F.
Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

GIROU, A.
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

GODAVARI, H. R.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

GOFF, J. D.
Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

GOODWIN, W.
Surface Containment for Geothermal Brines,
W81-02955 5G

GORDON, J. D.
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

GOSZ, J. R.
Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

GOTO, Y.
Water Treating Process,
W81-03024 5F

GOULD, J. P.
Disinfection,
W81-03172 5F

GOVE, G. W.
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

Pulp and Paper Industry Waste Water Management,
W81-03185 5D

GRANT, F. A.
Water Reuse: Projecting Markets and Costs,
W81-03072 3C

GRASMICK, A.
Experimental Study of Submerged Biological Filtration. (Etude Experimentale de la Filtration Biologique Immergee),
W81-03147 5D

GRASSLE, J. F.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

GREB, B. W.
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

GREEN, D. B.
Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

GREEN, H. A.
Flocculants for Aqueous Systems,
W81-03023 5F

GREENWALD, C. M.
Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

GREGORY, R. W.
Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

GRIFT, N. P.
Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

GROENEWOLD, J. C.
Dariy Wastes,
W81-03182 5D

GROVE, D. B.
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

GULVAS, J. A.
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

GUNN, J. M.
Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

HAAS, C. N.
Disinfection,
W81-03172 5F

HAIT, J. M.
Rotary Irrigation System,
W81-03015 3F

HALLOCK, D. L.
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

HAMPSON, G. R.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

HAMPTON, B. B.
Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

HARDER, H. W.
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

HARMAN, D. M.
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

HARRISON, P.
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

HARRISON, R. M.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

HART, O. O.
An Introduction to Water Renovation and Reclamation,
W81-03038 5D

Operational Guidelines,
W81-03050 5D

HARTENSTEIN, R.
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

HARTKORN, K. H.
Microbiological Method for Removing Pathogenic Microbes and Dissolved Organic Materials from Liquids,
W81-03019 5D

HASSETT, J. J.
Metal Pollutants in Agricultural Soils and the St. Louis Urban Rainfall Anomaly,
W81-03144 5B

HATTINGH, W. H. J.
Health Aspects,
W81-03051 5D

HATTON, D.
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

HAUCK, A. K.
Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

HAUSER, E. W.
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

HAWKINS, S. J.
Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

HAYES, R. J.
Guide Manual for Preparation of Water Balances,
W81-02971 6A

HECKY, R. E.
Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

HENDREY, G. R.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

HERBES, S. E.
Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

HERKELRATH, W. N.
Comment on 'Analysis of Water and Heat Flow in Unsaturated-Saturated Porous Media' by Marios Sophocleous,
W81-03085 2G

HERMELIN, L. G.
Method of Watering,
W81-03027 3F

HERRMANN, J. G.
Water Infiltration Control to Achieve Mine Water Pollution Control - The Dents Run Watershed Demonstration Project,
W81-02940 5G

HINCKLEY, T. M.
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

HINDALL, S. M.
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin,
W81-02912 2J

HINDE, G. M.
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

HITE, J. C.
Economics,
W81-03159 6C

HOA, N. T.
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

HOBBS, C. H.
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

HOBSON, J.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

HOCKING, D.
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

HOCKING, M. B.
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

HOFFARD, S. H.
Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
W81-02921 7B

HOLZER, T. L.
Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

HOOD, M. A.
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

HORNE, F. W.
Water Reuse: Projecting Markets and Costs,
W81-03072 3C

HOUSE, L. B.
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

HOWITT, R. E.
The Case for Regional Groundwater Management,
W81-03132 6B

HOYE, R. L. JR.
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

HUBBS, S. A.
Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

HUGHES, D. W.
Economics,
W81-03159 6C

HULL, R. W.
Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

HUNT, D. C.
Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

HUNTER, R. G.
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

HUSSAIN, A.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

HUTCHISON, J. S.
Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

II, M.
Water Treating Process,
W81-03024 5F

IRVINE, R. L.
Fermentation Industry,
W81-03181 5D

ISENSEE, A. R.
Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

JACKSON, T. A.
Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

JANARDAN, K. G.
Methods for Estimating the Number of Identifiable Organic Pollutants in the Aquatic Environment,
W81-03069 5A

JEFFERSON, P. O.
Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

JOHANSSON, C.
The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

JOHNSON, A. W.
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

JOHNSON, K. S.
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere,
W81-03104 5A

JOHNSON, W. K.
Guide Manual for Preparation of Water Balances,
W81-02971 6A

JOHNSON, W. W.
Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

JONES, J. G.
Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

JUDKINS, J. F. JR.
Textile Wastes,
W81-03184 5D

JUERGENS, E.
Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

JULIN, A. M.
Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

KALB, K. R.
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

KALKHOFF, S. J.
Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

KAPLAN, I. R.
Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

KARDOS, L. T.
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

KELLER, W.
Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

KENNEDY, L. A.
Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

KERAMIDA, V.
Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

KERNS, W. R.
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

KIDWELL, C. C.
Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

KIM, B. R.
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

KINZELBACH, W. K. H.
Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

KLEGRAF, F.
Process for Slow Softening Water,
W81-03021 5F

KLEMETSON, S. L.
Biological Filters,
W81-03165 5D

KNITTEL, M. D.
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

KOCH, N. C.
Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

KOEPSEL, W. D.
AWT Operating Procedures,
W81-03138 5D

KONCZA, L.
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

KONIKOW, L. F.
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

KOPFLER, F. C.
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

KORNEGAY, E. T.
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

KOSTYK, N.
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

KOWAL, N. E.
Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

KRUG, G.
Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

KRUP, M.
Denitrification,
W81-03168 5D

KUBO, S.
Water Treating Process,
W81-03024 5F

KUDEYAROV, V. N.
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

LABORDE, S. M.
Pathogenicity of Cercospora Rodmanii Conway on Eichhornia Crassipes (Mart.) Solms in Natchitoches Parish, Louisiana,
W81-02974 2I

LACHER, M.
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

LAHR, H.
Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

LAMBERT, W. P.
Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

LAPPLE, W. J.
Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

LAW, R.
Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

LEACH, J. M.
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

LEAF, A. L.
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

LECHEVALLIER, M. W.
Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

LEE, R. W.
Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

LEGGETT, W. C.
The Role of Fishes in the Regulation of Phosphorus Availability in Lakes,
W81-03226 2H

LEGITTIMO, P. C.
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

LEHMAN, O. R.
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

LEONARD, R. B.
Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

LEPAGE, W. L.
The Anatomy of an Ozone Plant,
W81-03077 5F

LEVENTHAL, L.
Surface Containment for Geothermal Brines,
W81-02955 5G

LEWIS, R. E.
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

LEWIS, W. M. JR.
Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

LIEBOW, E. B.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

LIGHT, R. W.
Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

LIKENS, G. E.
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

LITCHFIELD, J. H.
Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

LITTLE, L. W.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

LOGSDON, G. S.
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

LOKE, H. L.
Water Conditioner Rotary Value Structure,
W81-03032 5D

LONG, C. W.
Feasibility of Siphons for Degassing Water,
W81-03248 8I

LUKASIK, E. D.
AWT Operating Procedures,
W81-03138 5D

LUOMA, S. N.
The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

LYTLE, C. R.
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

MACLEMAN, E. L.
How to Cope with the SDWA/II,
W81-03209 7C

MAIR, D. M.
Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

MAJOR, C. W.
Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

MALE, J. W.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

MALLORY, M. J.
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

MANN, W. B. IV.
Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

MARINE, I. W.
Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

MARKS, D. H.
Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

MARSKE, D.
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

MARTENS, C. S.
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

MARTENS, D. D.
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

MARTIN, D. F.
Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

MARTIRE, A. A.
A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

MARTY, R.
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

MATTHEWS, J. R.
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

MAY, W. E.
The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

MAYES, F. M.
Oil Spill Cleanup Method and Apparatus,
W81-03026 5G

MCCRAKEN, R. A.
Groundwater Resources Management,
W81-03220 4B

MCCREARY, J. J.
Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

MCGOVERN, M. C.
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

MCHIE, W. F.
Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

MCKAY, G.
Principles of Dye Removal from Textile Effluent,
W81-03249 5D

MCKEOWN, J. J.
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

MCNEESE, J. A.
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

MCPHERSON, B. F.
Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

MEANS, E. G.
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

MEHOUDAR, R.
Drip Irrigation System,
W81-03028 3F

Drip Level Irrigation Emitter Unit,
W81-03017 3F

MELEAR, E. L.
Physical and Chemical Methods,
W81-03164 5D

MELTON, R. G.
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

MENG, H.
Organics,
W81-03163 5A

MENSER, H. A.
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

MERANGER, J. C.
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

MERIANOS, J. J.
Flocculants for Aqueous Systems,
W81-03023 5F

MERKS, A. G. A.
Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

MIDDAUGH, D. P.
Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

MIKITA, M.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

MILLER, G. L.
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

MILLER, J.
The Legal Implications of Ground Water Heat Pump Use,
W81-03148 6E

MILLER, R. D.
Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

MILLER, R. L.
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

MILLER, W. H.
Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing,
W81-03073 3D

MINOR, T. E.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

MITCHELL, R. N.
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

MOENCH, A. F.
A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

MOLLES, M. C. JR.
Effects of a Ski Area on the Water Quality and Invertebrates of a Mountain Stream,
W81-03203 5C

MOLVAR, A. E.
Multiple Stage Jet Nozzle and Aeration System,
W81-03034 5D

MONK, B. H.
Feasibility of Siphons for Degassing Water,
W81-03248 8I

MONSCVITZ, J. T.
A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

MONTGOMERY, J. C.
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

MORRA, J. J.
A Review of Water Quality Problems Caused by Various Open Distribution Storage Reservoirs,
W81-03218 5B

MORRIS, J. W.
Agricultural Wastes,
W81-03183 5D

MORSE, L. S.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

MUIR, D. C. G.
Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

MURPHY, W.
Surface Containment for Geothermal Brines,
W81-02955 5G

NAKANO, Y.
A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

NAKASHIMA, B. S.
The Role of Fishes in the Regulation of Phosphorus Availability in Lakes,
W81-03226 2H

NEBEKER, A. V.
Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

NELSON, D. B.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

NEMKE, J. L.
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

NESS, G. E.
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

NEUHAUSER, E. F.
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

NEUZIL, C. E.
Flow Through Fractures,
W81-03064 2F

NEWSON, H. D.
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

NEWTON, J. G.
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

NGUYEN, V. V.
Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

NIEUWENDIJK, P. J. H.
Dredging Vessel,
W81-03154 8A

NORMAN, D.
Organics,
W81-03163 5A

NORTON, S. A.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

NUCKTON, C. F.
The Case for Regional Groundwater Management,
W81-03132 6B

O'BOYLE, P. S.
Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

O'CONNER, J. T.
Guide to Comparative Treatment Mode Efficiencies,
W81-03190 5D

OGATA, A.
A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

OLNEY, C. E.
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

OLSEN, C. R.
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

OLSON, B. H.
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

OLTHIUS, P.
Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

ORON, G.
Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

OTIS, R. J.
On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

PAGE, A. L.
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

PAHREN, H. R.
Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

PAMPEYAN, E. H.
Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

PANTANI, F.
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

PATEL, I.
Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

PATERSON, R.
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

PATRY, G. G.
Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

PATTON, J. F.
Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

PAWLOWSKI, L.
Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

PAYNE, G. W.
Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

PECK, E. L.
Design of Precipitation Networks,
W81-03121 2B

PELHAM, L.
The Environmental Impact of Coal Transfer and Terminal Operations,
W81-02961 5B

PERDUE, E. M.
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

PERON, A.
Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

PETRASEK, A. C. JR.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

PETROCCI, A. N.
Flocculants for Aqueous Systems,
W81-03023 5F

PETTERSSON, K.
Alkaline Phosphatase Activity and Algal Surplus Phosphorus as Phosphorus-Deficiency Indicators in Lake Erken,
W81-02908 5A

PHIEN, H. N.
Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

PHILP, L. A.
Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

PICCARDI, G.
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

PICKERING, W. F.
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

PIERSON, M.
Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

PIPES, W. O.
Microbiology of Waste Water Treatment,
W81-03188 5D

PLAUT, T. R.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

POPKO, K. A.
Guide Manual for Preparation of Water Balances,
W81-02971 6A

POPP, C. J.
Transport Mechanisms in Sediment Rich Streams Heavy Metal and Nutrient Load of the Rio San Jose-Rio Puerco Systems,
W81-02902 5B

PORCELLA, D. B.
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

PRAKASAM, T. B. S.
Denitrification,
W81-03168 5D

PREMCHITT, J.
A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

PYTKOWICZ, R. M.
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere,
W81-03104 5A

PYTLAR, T. JR.
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

QUADE, H. W.
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

QUERNA, P. W.
Groundwater Is Best for Hatchery Fish,
W81-03228 8I

RAATS, P.
Underground Travel of Renovated Waste Water,
W81-03113 3C

RANDOLPH, J. C.
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

RANDS, M. B.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

RANI, S.
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

RAVEH, A.
Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

REDDELL, D. L.
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

REED, G. D.
Water Characteristics,
W81-03162 5B

REID, B. H.
Alaska Village Demonstration Projects. Final Report,
W81-02944 5D

REILLY, J. K.
Management of Water Quality and Treatment,
W81-03219 5F

REITZEL, J.
Surface Containment for Geothermal Brines,
W81-02955 5G

REXING, D. J.
A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

REYNOLDS, J. H.
Land Application of Waste Water,
W81-03175 5D

REYNOLDS, T. D.
Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

RHODES, W. A.
Solar Desalination System,
W81-03029 3A

RIBEYRE, F.
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

RICE, R. C.
Underground Travel of Renovated Waste Water,
W81-03113 3C

RICHARDSON, C. W.
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation,
W81-03063 2B

RICHARDSON, D. B.
Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

RICHTER, J. E.
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

RIDGWAY, H. F.
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

RIGGS, V. L.
Environmental Effects of Western Coal Surface Mining, Part V - Age and Growth of Walleyes and Saugers in the Tongue River Reservoir, Montana, 1975-77,
W81-02958 5C

RISK, G.
Magnetic Treatment Devices for Water Pipelines,
W81-03035 5G

ROARABAUGH, D. B.
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

ROBERTS, R. S.
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

ROBERTSON, T. E.
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

ROBINSON, K. M.
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

RODRICK, G. E.
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

ROESLER, J. F.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

ROFF, J. C.
Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

ROGERS, G. L.
Biological Filters,
W81-03165 5D

ROHDE, W. A.
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

ROLAN, A. T.
Treatment Improved through Process Control,
W81-03142 5D

ROLFE, K. A.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

RONEN, M.
Clarification,
W81-03039 5D

Sludge Dewatering,
W81-03047 5D

ROQUES, H.
Treatment of Urban or Industrial Effluents by Entrainment of Pollutants with the Precipitation of CaCO3. (Traitement des Effluents Urbains ou Industriels Par Entrainement des Polluants A L'Occasion D'Une Precipitation de CaCO3),
W81-03215 5D

ROSS, J. D.
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

ROY, D.
Microbiology - Detection, Occurrence, and Removal of Viruses,
W81-03187 5G

RUANE, R. J.
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

RUESS, R. W.
Daily Fluctuations in Water Potential and Associated Ionic Changes in Atriplex Canescens,
W81-03250 2D

RULIFSON, R.
Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

RUMEU SOLDEVILLA, J.
Total Elimination of Floating Solids in Ocean Discharge of Treated Effluent. (Elimacion Total

de Solidos Flotantes en el Vertido al mar de Aguas Residuales),
W81-03151 5D

RUNNER, G. S.
West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

SABANSKAS, M.
Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

SANDERS, H. L.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

SANDERS, H. O.
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

SANFORD, T. H. JR.
Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

SANSONE, F. J.
Methane Production from Acetate and Associated Methane Fluxes from Anoxic Coastal Sediments,
W81-03095 5C

SAUTIER, J. L.
Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

SAVAGE, D. W.
Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column,
W81-03097 5F

SCHAEFER, D. H.
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

SCHAEFER, O. E.
Watershed Management,
W81-03221 5G

SCHAFER, D. C.
Pumping Test Analyses for Low Yield Formations,
W81-03229 7B

SCHOFIELD, C. L.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

SCHUK, W. W.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

SEIDLER, R. J.
Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

SEPHTON, H. H.
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

SEWELL, W. R. D.
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

SHABMAN, L.
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

SHAFFER, P. W.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

SHARMA, M. N.
Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

SHELEF, G.
Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

SHIBAN, S. S.
Water Screen,
W81-03036 5G

SHIH, S. F.
Water Budget Computation in Lake Okeechobee,
W81-03100 2D

SHPORN, S.
Computer-Controlled Irrigation System,
W81-03016 3F

SHULL, K. E.
Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

SHUMAN, M. S.
Inorganics,
W81-03161 5A

SIEGEL, D. I.
The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

SIMMONS, B. P.
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

SIMON, B. M.
Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

SIMONEIT, B. R. T.
Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

SIMPSON, H. J.
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

SINKE, J. J.
Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

SKAVRONECK, S.
Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

SLADE, R. M. JR.
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

SLAGLE, S. E.
Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

SLATER, R. W.
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

SMITH, D. W.
Water Reclamation and Reuse,
W81-03174 5D

SMITH, L. L. JR.
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

SMITH, S. R.
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

SMITH, T. E.
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

SMYTH, T. A.
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

SNOEYINK, V. L.
Organic Compounds Produced by the Aqueous Free-Chlorine-Activated Carbon Reaction,
W81-03087 5A

Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

SODERQUIST, M. R.
Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

SOLOMON, J.
Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

SOMERS, G. F.
Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

SONI, J. P.
Unsteady Sediment Transport Law and Prediction of Aggradation Parameters,
W81-03053 2J

SORENSEN, D. L.
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

SPENCER, M. J.
Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

SPOSITO, G.
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

SPROUT, O. S.
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

SRIVASTAVA, V. J.
Anaerobic Processes,
W81-03167 5G

STAKMAN, W. P.
The Determination of Soil-Water Desorption Curves for Soil Cores,
W81-03232 2G

STANDRIDGE, J. H.
Poor Sludge Settleability Caused by the Bacterium Lampropedia,
W81-03139 5D

STANNERS, D. A.
Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

STANWOOD, R. M.
Environmental Issues: Still Clouded in Uncertainty,
W81-03107 5C

STEDINGER, J. R.
Systems Analysis,
W81-03158 6A

STEELINK, C.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

STEPHENS, R. D.
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

STEVENS, D. G.
Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

STIMSON, J. R.
Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

STORM, D. L.
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

STORTZ, K.
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

STOTTLEMYER, J. R.
Evolution of Management Policy and Research in the National Parks,
W81-03120 6G

STRUS, R.
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

STUDLICK, J.
Bottled Water: Expensive Groundwater,
W81-03153 5A

SUBRAMANIAN, K. S.
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

SUNG, R.
Surface Containment for Geothermal Brines,
W81-02955 5G

SUTCLIFFE, H. JR.
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

SUTHERLAND, J.
Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

SUZUKI, T.
Water Treating Process,
W81-03024 5F

SVEINBJORNSSON, H.
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

SWAYZE, L. J.
Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

SWEENEY, A. G.
Principles of Dye Removal from Textile Effluent,
W81-03249 5D

SWENSON, W. A.
Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

SYDOR, M.
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

SYMONS, J. M.
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

TAI, Y. C.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

TANAKA, J.
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

TASKER, G. D.
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

TAYLOR, T. P.
The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

TEASDALE, W. E.
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

TEMPLIN, W. E.
Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

TESKEY, R. O.
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

THOMPSON, R. A.
Water Law - Refusing Irrigation Waste Water on Different Lands: A Warning to Get a New Permit,
W81-03102 6E

THOMSON, E. A.
The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

THORN, K.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

TIETJEN, J. H.
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

TOAL, M. G.
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

TORNES, L. H.
Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

TRACY, J. V.
Flow Through Fractures,
W81-03064 2F

TRANUM, W. M.
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

TSIATIS, A. A.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

TSUCHIGANE, R.
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

TUOVINEN, O. H.
Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

TYAGI, A. K.
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

VALDERRAMA, J. C.
The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters,
W81-03103 7B

VAN DEN BERG, D. M.
Unit Water Consumption for Towns in South Africa,
W81-03233 6D

VAN LEEUWEN, J.
Chlorine Disinfection,
W81-03044 5D

Final Treatment,
W81-03049 5D

Ozone Disinfection,
W81-03045 5D

Softening and Recarbonation,
W81-03042 5D

VAN VLIET, B. M.
Active Carbon Adsorption,
W81-03046 5D

Carbon Regeneration,
W81-03048 5D

Quality Equalization,
W81-03040 5D

VAN VUUREN, L. R. J.
Ammonia Stripping,
W81-03041 5D

Filtration,
W81-03043 5D

VARHOL, B. P.
Restoring Wells Is No Gamble in Las Vegas,
W81-03230 3B

VERGNAULT, J.
Process for Biological Denitrification of Effluents,
W81-03020 5D

VERMA, S. R.
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

VESILIND, P. A.
Sludge Treatment, Utilization, and Disposal,
W81-03169 5D

VIAL, J.
Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

VISHNIPOLSKY, J.
Computer-Controlled Irrigation System,
W81-03016 3F

VIVONA, M. A.
Gas-Liquid Dissolution in Waste Water Treatment,
W81-03247 5D

VOGT, C. R.
High Speed Liquid Chromatography as an Environmental Monitor of Non-Volatile Organic Pollutants in Water: in Retrospect--A New Perspective,
W81-03002 5C

VON ZWECK, O. H.
Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

VONDRICK, A. F.
Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

VOSS, R. H.
Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

VOSSER, J. L.
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

VOTO, S. J.
Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

WAARVICK, C. E.
Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies,
W81-03091 5A

WALI, M. K.
Daily Fluctuations in Water Potential and Associated Ionic Changes in Atriplex Canescens,
W81-03250 2D

WALKER, W. R.
Law,
W81-03160 6E

Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

WALPOLE, J. R.
Federal Water Pollution Laws and Mining--A Summary,
W81-03108 6E

WALTERS, M. A.
Impact of Water Level Changes on Woody Riparian and Wetland Communities, Volume VIII, Pacific Northwest and Rocky Mountain Regions,
W81-02939 2I

WANG, C-J.
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors,
W81-02935 5D

WASSON, B. E.
Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

WATT, M. H.
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

WAYGOOD, E. R.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

WEARING, J. T.
Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

WEBSTER, D. A.
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

WEIGEL, J. F.
Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

WEINSTEIN, M.
Flocculants for Aqueous Systems,
W81-03023 5F

WEITZ, S. L.
Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

WELCH, J. S.
Treatment Improved through Process Control,
W81-03142 5D

WENDLE, J. G.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation,
W81-02949 3E

WHIPPLE, W. JR.
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

WHITE, E.
Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

WHITE, E. B.
Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

WIECHERS, H. N. S.
Softening and Recarbonation,
W81-03042 5D

WILCOX, J.
Wastewater Collection,
W81-03173 5D

WILHELM, R. G.
Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

WILLEY, R. E.
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

WILLIAMS, J. R.
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

WILLIAMS, R. B.
The EPA Value Engineering Program. Part I: What it is and What it does,
W81-03081 6B

The EPA Value Engineering Program: Part II,
W81-03082 6A

WILLIS, C. E.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

WILLMON, J. R.
Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

WILSON, E. T.
AWT Operating Procedures,
W81-03138 5D

WINANT, W. M.
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

WINTER, T. C.
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

WONG, A.
Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

WOO, C-P.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

WOOD, C. M.
Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

WOOD, E. F.
Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

WOOD, W. A.
Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

YAN, N. D.
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

YOCKIM, R. S.
Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

YOUNG, H. W.
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

ZAIM, M.
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

ZALEWSKI, R.
Ion Exchange in the Recycling of Plating Effluents,
W81-03240 5D

ZEDLER, J. B.
Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

ZEITOUN, I. H.
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

ZOLTEK, J. JR.
Physical and Chemical Methods,
W81-03164 5D

ZUR, B.
Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BELLE GLADE, FL.
Water Budget Computation in Lake Okeechobee,
W81-03100 2D

AKADEMIYA NAUK SSSR, PUSHCHINO. INST. OF AGROCHEMISTRY AND SOIL SCIENCES.
Nitrogen Balance in Small River Basins Under Agricultural and Forestry Use,
W81-03199 5B

ALBANY COUNTY SEWER DISTRICT, NY.
Albany County Sewer District, New York,
W81-03239 5D

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Water Reclamation and Reuse,
W81-03174 5D

ALEXANDRIA UNIV. (EGYPT). DEPT. OF OCEANOGRAPHY.
Distribution and Ecology of Marine Fungi in Sierra Leone (Tropical West Africa),
W81-03214 5B

ALLEGHENY COUNTY SANITARY AUTHORITY, PITTSBURGH, PA.
A Disposal-Costing Method for Evaluating Sludge Dewatering Chemicals,
W81-03136 5D

ARIZONA UNIV., TUCSON. DEPT. OF CHEMISTRY.
Organic Pollutants in Ground-Recharged Water,
W81-03008 5A

ARMY ENGINEER DISTRICT, TULSA, OK.
Organochlorine Residues in Fish of Lake Texoma, October 1979,
W81-03093 5C

ARMY ENVIRONMENTAL HYGIENE AGENCY, EDGEWOOD ARSENAL, MD.
Human Factors in Design and Operation of Water Reuse Facilities,
W81-03137 6A

ASIAN INST. OF TECH., BANGKOK (THAILAND).
A Technique in Using Integrodifferential Equations for Model Simulation of Multiaquifer Systems,
W81-03061 2F

Range Analysis of Exchangeable Normal Variables,
W81-03067 4A

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND).
The Absorption of Tritium Gas by English Soils, Plants and the Sea,
W81-03204 5B

AUBURN UNIV., AL. DEPT. OF CIVIL ENGINEERING.
Textile Wastes,
W81-03184 5D

AUCKLAND FARMER'S FREEZING CO-OPERATIVE CO., LTD. (NEW ZEALAND). CENTRAL LAB.
Compost Filters for H2S Removal from Anaerobic Digestion and Rendering Exhausts,
W81-03133 5D

BALLAST-NEDAM GROEP, N.V., AMSTELVEEN (NETHERLANDS). (ASSIGNEE); AND AMSTERDAMSE BALLAST BAGGER EN GROND (NETHERLANDS).
Dredging Vessel,
W81-03154 8A

BATTELLE COLUMBUS LAB., OH.
Meat, Fish, and Poultry Processing Wastes,
W81-03179 5D

BATTELLE PACIFIC NORTHWEST LAB., RICHLAND, WA.
Application of Buoyant Mass Transfer Media to Hazardous Material Spills,
W81-02959 5G

BATTELLE. PACIFIC NORTHWEST LAB., RICHLAND, WA. ECOLOGICAL SCIENCES DEPT.
Gas Bubble Disease in Smallmouth Bass and Northern Squawfish from the Snake and Columbia Rivers,
W81-03246 5C

BEN-GURION UNIV. OF THE NEGEV, SDE BOKER (ISRAEL). INST. FOR DESERT RESEARCH.
Optimal Design and Operation of Permanent Irrigation Systems,
W81-03052 3F

Stormwater and Reclaimed Effluent in Trickle Irrigation,
W81-03123 3C

BORDEAUX-1 UNIV., TALENCE (FRANCE). LAB. D'ECOLOGIE ANIMALE.
Bioaccumulation and Bioamplification of Mercury Derivatives by a Tertiary Consumer: Salmo Gairdneri - Temperature Effects. (Bioaccumulation Et Bioamplification Des Derives Du Mercure Par Un Consommateur De Troisieme Ordre: Salmo Gairdneri - Incidences Du Facteur Temperature),
W81-03191 5C

BORDEAUX UNIV. (FRANCE). LAB. OF ECOLOGY AND ANIMAL ECOPHYSIOLOGY.
Transfer of Methylmercury in an Experimental Freshwater Trophic Chain--Temperature Effects,
W81-03088 5B

BRITISH ANTARCTIC SURVEY, CAMBRIDGE (ENGLAND).
Aliphatic and Aromatic Hydrocarbons in Benthic Invertebrates from Two Sites in Antarctica,
W81-03119 5B

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER.
Development of a Chemical Toxicity Assay for Pulp Mill Effluents,
W81-02941 5A

BROOKHAVEN NATIONAL LAB., UPTON, NY.
Geological and Hydrochemical Sensitivity of the Eastern United States to Acid Precipitation,
W81-02952 5B

CAHN, INC., WALLINGFORD, CT.
Gas-Liquid Dissolution in Waste Water Treatment,
W81-03247 5D

CALIFORNIA DEPT. OF HEALTH SERVICES, BERKELEY.
Samplers and Sampling Procedures for Hazardous Waste Streams,
W81-02946 7B

CALIFORNIA UNIV., BERKELEY. COLL. OF ENGINEERING.
Vertical Tube Foam Evaporation Applied for Heat Transfer Enhancement in a Commercial Plant and to Vapor Compression Distillation of Saline Water,
W81-02903 3A

CALIFORNIA UNIV., BERKELEY. DEPT. OF FORESTRY AND RESOURCE MANAGEMENT.
The Littoral Bottom Fauna of High Elevation Lakes in Kings Canyon National Park,
W81-03223 5C

CALIFORNIA UNIV., DAVIS. DEPT. OF AGRICULTURAL ECONOMICS.
The Case for Regional Groundwater Management,
W81-03132 6B

CALIFORNIA UNIV., IRVINE. ENVIRONMENTAL ANALYSIS DIV.
Iron Bacteria in Drinking-Water Distribution Systems: Elemental Analysis of Gallionella Stalks, Using X-Ray Energy-Dispersive Microanalysis,
W81-03092 5A

CALIFORNIA UNIV., LOS ANGELES. DEPARTMENT OF EARTH AND SPACE SCIENCES.
Extractable Organic Matter in Urban Stormwater Runoff. 2. Molecular Characterization,
W81-03157 5A

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF EARTH AND SPACE SCIENCES.
Extractable Organic Matter in Urban Stormwater Runoff. 1. Transport Dynamics and Mass Emission Rates,
W81-03156 5B

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Effects of Acid Precipitation on Soil Leachate Quality, Computer Calculations,
W81-02954 5B

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Bacterial Density in Water Determined by Poisson or Negative Binomial Distributions,
W81-03130 5A

CAWTHRON INST., NELSON (NEW ZEALAND).
Seasonal Variation of Heterotrophic Potential in Lake Rotoroa,
W81-03235 2H

CENTER FOR URBAN ENVIRONMENTAL STUDIES, WASHINGTON, DC.
Minority Water Awareness Program.
W81-02910 6E

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, TOULOUSE (FRANCE). INST. DE MECANIQUE DES FLUIDES.
A New Method Allowing the Measurement of Rapid Variations of the Water Content in Sandy Porous Media,
W81-03054 2G

CHANDLER PUBLIC WORKS DEPT., AZ.
Chandler's Systems Staying on Top of Growing Needs,
W81-03140 6D

CHICAGO DEPT. OF PUBLIC WORKS, IL. BUREAU OF ENGINEERING.
Lawrence Avenue Underflow Sewer System, Interim Report, Planning and Construction,
W81-02950 5G

CHINESE ACADEMY OF SCIENCE, PEKING. INST. OF ENVIRONMENTAL CHEMISTRY.
Managing the Cooling Capacity of the Upper Rhine: A Case Study,
W81-03106 5B

CITY UNIV. OF NEW YORK. DEPT. OF BIOLOGY.
Population Structure and Species Composition of the Free-Living Nematodes Inhabiting Sands of the New York Bight Apex,
W81-03152 5C

CLEMSON UNIV., SC.

CLEMSON UNIV., SC.
Economics,
W81-03159 6C

CLEVEPAK CORP., WHITE PLAINS, NY. (ASSIGNEE).
Multiple Stage Jet Nozzle and Aeration System,
W81-03034 5D

CLYDE RIVER PURIFICATION BOARD, GLASGOW (SCOTLAND).
Water Pollution Resulting from a Fire at a Tyre Dump,
W81-03089 5B

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
A Traveling Wave Solution to the Problem of Simultaneous Flow of Water and Air through Homogeneous Porous Media,
W81-03056 2G

COLORADO STATE UNIV. AT BOULDER.
Biological Filters,
W81-03165 5D

COLORADO UNIV. AT BOULDER. DEPT. OF ENVIRONMENTAL, POPULATION, AND ORGANISMIC BIOLOGY.
Precipitation Chemistry and Nutrient Loading by Precipitation in a Tropical Watershed,
W81-03062 5B

CONNECTICUT UNIV., STORRS. DEPT. OF CHEMISTRY.
Sampling and Preconcentration Methods for the Analysis of Polycyclic Aromatic Hydrocarbons in Water Systems,
W81-03013 5A

CONSUMERS POWER CO., JACKSON, MI. DEPT. OF ENVIRONMENTAL SERVICES.
Effectiveness of Fine Mesh Cylindrical Wedge-Wire Screens in Reducing Entrainment of Lake Michigan Ichthyoplankton,
W81-03126 8I

CORNELL UNIV., ITHACA, NY.
Systems Analysis,
W81-03158 6A

CORNELL UNIV., ITHACA, NY. DEPT. OF AGRICULTURAL ENGINEERING.
Agricultural Wastes,
W81-03183 5D

CORNELL UNIV., ITHACA, NY. DIV. OF BIOLOGICAL SCIENCES.
Importance of Organic Debris Dams in the Structure and Function of Stream Ecosystems,
W81-03118 5B

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR.
Effects of Hydrostatic Pressure on Steelhead Survival in Air-Supersaturated Water,
W81-03242 5C

Comparative Responses of Speckled Dace and Cutthroat Trout to Air-Supersaturated Water,
W81-03243 5C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. FRESHWATER DIV.
Alaska Village Demonstration Projects. Final Report,
W81-02944 5D

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR. WESTERN FISH TOXICOLOGY STATION.
Avoidance Responses of Salmon and Trout to Air-Supersaturated Water,
W81-03244 5C

CULP/WESNER/CULP, CAMERON PARK, CA.
The EPA Value Engineering Program. Part I: What it is and What it does,
W81-03081 6B

The EPA Value Engineering Program: Part II,
W81-03082 6A

D.A.V. COLL., MUZAFFARNAGAR (INDIA). POLLUTION RELEVANT RESEARCH LAB.
Evaluation of Acute Toxicity of Phenol and Its Chloro- and Nitro-Derivatives to Certain Teleosts,
W81-03202 5C

DELAWARE UNIV., NEWARK. DEPT. OF CHEMICAL ENGINEERING.
Design and Control of an Activated Sludge Process for Municipal Waste Water Treatment,
W81-02905 5D

DELAWARE UNIV., NEWARK. SCHOOL OF LIFE AND HEALTH SCIENCES.
Salinity and Production of Food Crops: A Problem from Antiquity, A Challenge for the Future,
W81-03006 3C

DELTA INST. FOR HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
Application of an Automated Method for Dissolved Sulphate Analysis to Marine and Brackish Waters,
W81-03105 5A

DENVER WATER DEPT. CO.
Denver's ECH2ONERGY Program: A Boon to Homebuyers, A Boost for Housing,
W81-03073 3D

DEPARTMENT OF ENERGY, WASHINGTON, DC.
They're in Hot (Geothermal) Water in Boise,
W81-03231 2F

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING, BOSTON, MA. DIV. OF WATER SUPPLY.
Groundwater Resources Management,
W81-03220 4B

DEPARTMENT OF FISHERIES AND OCEANS, WINNIPEG (MANITOBA). FRESHWATER INST.
Extraction and Cleanup of Fish, Sediment, and Water for Determination of Triaryl Phosphates by Gas-Liquid Chromatography,
W81-03071 5A

Teratogenesis in Lake Trout (Salvelinus Namaycush) in an Experimentally Acidified Lake,
W81-03116 5C

DEPARTMENT OF INDUSTRY, LONDON (ENGLAND). LAB. OF THE GOVERNMENT CHEMIST.
Determination of Polynuclear Aromatic Hydrocarbons in Food, Water and Smoke Using High-Performance Liquid Chromatography,
W81-03129 5A

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND). FRESHWATER SECTION.
Relative Importance of Microflora and Allophanic Clays to the Phosphorus Dynamics of Lake Rerewhakaaitu,
W81-03236 2H

DEPARTMENT OF THE ENVIRONMENT, LONDON (ENGLAND)
Chemically Aided Settlement of Crude Sewage,
W81-03150 5D

DEUTSCHE GESELLSCHAFT FUER WIEDERAUFARBETTUNG VON KERNBRENNSTOFFEN M.B.H., HANOVER (GERMANY, F.R.). (ASSIGNEE).
Process for the Working up and Regeneration of Wash Waters Containing Ammonium,
W81-03025 5D

DISTRICT OF COLUMBIA UNIV., WASHINGTON. WATER RESOURCES RESEARCH CENTER.
Notes on Water Supply Interconnections, Institutional Factors,
W81-02906 6E

DREXEL UNIV., PHILADELPHIA, PA.
Microbiology of Waste Water Treatment,
W81-03188 5D

DU PONT DE NEMOURS (E. I.) AND CO., AIKEN, SC. SAVANNAH RIVER LAB.
Osmotic Model to Explain Anomalous Hydraulic Heads,
W81-03058 2F

DUKE UNIV., DURHAM, NC. DEPT. OF CIVIL ENGINEERING.
Sludge Treatment, Utilization, and Disposal,
W81-03169 5D

DURHAM CITY, NC. DIV. OF WATER RESOURCES.
Treatment Improved through Process Control,
W81-03142 5D

ECOLE POLYTECHNIQUE, MONTREAL (QUEBEC). DEPT. OF CIVIL ENGINEERING.
Analysis and Design of Equalization Basins by Continuous Simulation. (Analyse et Dimensionnement des Bassins D'Equilibre per Simulation Continue),
W81-03225 5D

ENVIRONMENTAL PROTECTION AGENCY, BELTSVILLE, MD. PESTICIDE DEGRADATION LAB.
Freshwater Micro-Ecosystem Development and Testing of Substitute Chemicals,
W81-02956 5C

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH.
Evaluating Costs and Benefits of Alternative Disinfectants,
W81-03078 5F

Determination of Organic Contaminants by the Grob Closed-Loop-Stripping Technique,
W81-03080 5A

Health Effects Associated with Waste Water Treatment and Disposal,
W81-03178 5D

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. DRINKING WATER RESEARCH DIV.
Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models,
W81-03079 5F

ENVIRONMENTAL PROTECTION AGENCY, EDISON, NJ.
Urban Runoff and Combined Sewer Overflow,
W81-03176 5B

ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. OFFICE OF RESEARCH AND DEVELOPMENT.
Instrumentation and Automation of Waste Water Collection and Treatment Systems,
W81-03177 5D

EXXON RESEARCH AND ENGINEERING CO., LINDEN, NJ.
Investigations of Solvent-Regenerable Carbon-Sulfur Surface Compounds for Phenol Removal in a Packed Column,
W81-03097 5F

FILTERS INTERNATIONAL INC., CHICAGO, IL. (ASSIGNEE).
Methods for Use in Water Purification Particularly Sewage Treatment,
W81-03022 5D

FISH AND WILDLIFE SERVICE, COLUMBIA, MO. FISH-PESTICIDE RESEARCH LAB.
Sublethal Effects of Toxaphene on Daphnids, Scuds, and Midges,
W81-02947 5C

Acute Toxicity of Toxaphene to Fathead Minnows, Channel Catfish, and Bluegills,
W81-02948 5C

FISH AND WILDLIFE SERVICE, LAUREL, MD. PATUXENT WILDLIFE RESEARCH CENTER.
Effects of Petroleum Hydrocarbons on Hepatic Function in the Duck,
W81-03234 5C

Response of Captive, Breeding Mallards to Oiled Water,
W81-03237 5C

FISHERIES AND MARINE SERVICE, WINNIPEG (MANITOBA).
Depression of Primary Productivity by Humic Matter in Lake and Reservoir Waters of the Boreal Forest Zone,
W81-03227 2H

FLORENCE UNIV. (ITALY). INST. OF ANALYTICAL CHEMISTRY.
Cu, Pb, and Zn Determination in Rainwater by Differential Pulse Anodic Stripping Voltammetry,
W81-03200 5A

FLORIDA INST. OF TECH., MELBOURNE.
Hydrographic Features of Fort Pierce Inlet, Florida,
W81-03201 2L

FLORIDA UNIV., GAINESVILLE.
Physical and Chemical Methods,
W81-03164 5D

FRESHWATER BIOLOGICAL ASSOCIATION, WINDERMERE (ENGLAND).
Decomposition Processes in the Profundal Region of Blelham Tarn and the Lund Tubes,
W81-03196 2H

GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.
Surficial Geophysical Data for Two Cross-Valley Lines in the Middle Eagle River Valley, Alaska,
W81-02993 2F

GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.
Hydrologic Data for Urban Studies in the Austin, Texas Metropolitan Area, 1978,
W81-02977 7C

Hydrologic Data for Mountain Creek, Trinity River Basin, Texas, 1978,
W81-02979 7C

Hydrologic Data for North Creek, Trinity River Basin, Texas, 1978,
W81-02981 2E

GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.
Hydrology and Geochemistry of Thermal Groundwater in Southwestern Idaho and North-Central Nevada,
W81-02990 1A

Surface-Water Data for Idaho, 1971-75,
W81-02991 7C

GEOLOGICAL SURVEY, BOSTON, MA. WATER RESOURCES DIV.
Hydrologic Data of the Coastal Drainage Basins of Southeastern Massachusetts, Northwest Shore of Buzzards Bay,
W81-02917 7C

Hydrologic Data of the Coastal Drainage Basins of Northeastern Massachusetts, from Castle Neck River, Ipswich, to Mystic River, Boston,
W81-02918 7C

GEOLOGICAL SURVEY, CHARLESTON, WV. WATER RESOURCES DIV.
West Virginia Department of Highways Research Project 16, 'Runoff Studies on Small Drainage Areas' (Technique for Estimating Magnitude and Frequency of Floods in West Virginia),
W81-02985 2E

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Effect of Pumpage on Groundwater Levels as Modeled in Laramie County, Wyoming,
W81-02923 2A

Effects of Herbicide Usage on Water Quality of Selected Streams in Wyoming,
W81-02924 5C

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.
Hydrologic Setting of Wetlands in the Cottonwood Lake Area, Stutsman County, North Dakota,
W81-02919 7C

Hexavalent Chromium in Ground and Surface Waters Near Telluride, Colorado -- A Preliminary Data Report --,
W81-02982 5A

GEOLOGICAL SURVEY, FORT WORTH, TX. WATER RESOURCES DIV.
Hydrologic Data for Urban Studies in the Dallas, Texas, Metropolitan Area, 1978,
W81-02980 2E

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Hydrogeologic Data for Selected Coal Areas, East-Central Montana,
W81-02922 7C

Geothermal Gradients in the Missoula and Bitterroot Valleys, West-Central Montana,
W81-02930 1A

Changes in Quality of Groundwater in the Lincoln Area, Montana, 1974-79,
W81-02976 5B

Magnitude and Chemical Quality of Base Flow of Otter Creek, Tongue River, and Rosebud Creek, Southeastern Montana, October 26-November 5, 1977,
W81-02988 5A

GEOLOGICAL SURVEY, HONOLULU, HI. WATER RESOURCES DIV.
Test Drilling in Basalts, Lalamilo Area, South Kohala District, Hawaii,
W81-02987 8C

GEOLOGICAL SURVEY, HOUSTON, TX. WATER RESOURCES DIV.
Hydrologic Data for Urban Studies in the Houston, Texas, Metropolitan Area, 1978,
W81-02978 7C

GEOLOGICAL SURVEY, HURON, SD. WATER RESOURCES DIV.
Techniques for Estimating Flood Peaks, Volumes, and Hydrographs on Small Streams in South Dakota,
W81-02929 2E

Appraisal of the Water Resources of the Big Sioux Aquifer, Brookings, Deuel, and Hamlin Counties, South Dakota,
W81-02932 2F

GEOLOGICAL SURVEY, JACKSON, MS. WATER RESOURCES DIV.
Quality of Water in the Tallahatchie River near New Albany, Mississippi,
W81-02986 5A

Water-Level Map of the Mississippi Delta Alluvium in Northwestern Mississippi, September 1980,
W81-02996 7C

GEOLOGICAL SURVEY, KNOXVILLE, TN. WATER RESOURCES DIV.
Water-Level Data for Wells in Burial Ground 6, Oak Ridge National Laboratory, Tennessee, 1975-1979,
W81-02989 5E

GEOLOGICAL SURVEY, LAKEWOOD, CO.
Measurement and Computation of Bed-Material Discharge in a Shallow Sand-Bed Stream, Muddy Creek, Wyoming,
W81-03060 2J

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Availability of Surface Water in Autauga County, Alabama,
W81-02997 7C

Availability of Surface Water in Montgomery County, Alabama,
W81-02999 7C

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Sediment Deposition in the White River Reservoir, Northwestern Wisconsin,
W81-02912 2J

Comparison of the Propane-Area Tracer Method and Predictive Equations for Determination of Stream-Reaeration Coefficients on Two Small Streams in Wisconsin,
W81-02995 5A

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Earth Fissures and Localized Differential Subsidence,
W81-03066 2F

A Numerical Inversion of the Laplace Transform Solution to Radial Dispersion in a Porous Medium,
W81-03070 2F

Comment on 'Analysis of Water and Heat Flow in Unsaturated-Saturated Porous Media' by Marios Sophocleous,
W81-03085 2G

The Effect of Sample Storage on the Extraction of Cu, Zn, Fe, Mn, and Organic Material from Oxidized Estuarine Sediments,
W81-03207 5A

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Potential Effects of Increased Groundwater Pumpage on Barka Slough, San Antonio Creek Valley, Santa Barbara County, California,
W81-02915 4B

Water-Quality Data from Taylor Creek Drainage Basin, El Dorado County, California, July 1975 through October 1976,
W81-02920 7C

Feasibility of Using an Acoustic Velocity Meter to Measure Flow in the Chipps Island Channel, Suisun Bay, California,
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GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.

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Flow Through Fractures,
W81-03064 2F

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
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GEOLOGICAL SURVEY, SAINT PAUL, MN.
The Effect of Snowmelt on the Water Quality of Filson Creek and Omaday Lake, Northeastern Minnesota,
W81-03068 5B

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.
Hydrology and Water Quality of the Copper-Nickel Study Region, Northeastern Minnesota,
W81-02925 7C

Preimpoundment Water Quality of the Wild Rice River, Norman County, Minnesota,
W81-02931 5C

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Seepage Study for Unnamed Tributary to Alder Creek, Stevens County, Washington,
W81-02916 2E

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Data on Ground-Water Quality With Emphasis on Radionuclides, Sarasota County, Florida,
W81-02926 5B

Lithologic Logs and Geophysical Logs from Test Drilling in Palm Beach County, Florida, Since 1974,
W81-02983 7C

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979,
W81-02984 7C

Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December 1977,
W81-02992 5B

Relation Between Freshwater Flow and Salinity Distributions in the Alafia River, Bullfrog Creek, and Hillsborough Bay, Florida,
W81-02994 2L

Hydrologic and Land-Cover Features of the Loxahatchee River Basin, Florida,
W81-03000 7C

GEOLOGICAL SURVEY, UNIVERSITY, AL. WATER RESOURCES DIV.
Sample Descriptions for Test Wells Penetrating Deep Aquifers in Dallas and Sumter Counties, Alabama,
W81-02927 6B

Water Availability and Geology of Sumter County, Alabama,
W81-02998 7C

GEORGIA INST. OF TECH., ATLANTA.
Organics,
W81-03163 5A

GORE AND STORRIE, LTD., TORONTO (ONTARIO).
Toronto Turns Sludge into Energy,
W81-03112 5E

GREELEY AND HANSEN, CHICAGO, IL.
AWT Operating Procedures,
W81-03138 5D

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Phytoplankton of Fresh-Water Origins in Hudson Bay,
W81-03094 5C

GULF BREEZE ENVIRONMENTAL RESEARCH LAB., JOHNS ISLAND, SC, BEARS BLUFF FIELD STATION.
Toxicological and Physiological Responses of the Fish, Leiostomus Xanthurus, Exposed to Chlorine Produced Oxidants,
W81-03192 5C

HAMPTON (DELON) AND ASSOCIATES, SILVER SPRING, MD.
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W81-02961 5B

HANOVER UNIV. (GERMANY, F.R.). INST. OF WATER RESOURCES, HYDROLOGY AND AGRICULTURAL ENGINEERING.
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W81-03055 5F

HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MA.
Disease Outbreaks Caused by Drinking Water,
W81-03186 5C

HEALTH AND WELFARE CANADA, OTTAWA (ONTARIO). HEALTH PROTECTION BRANCH; AND ENVIRONMENTAL HEALTH CENTRE, OTTAWA (ONTARIO).
Survey for Cadmium, Cobalt, Chromium, Copper, Nickel, Lead, Zinc, Calcium, and Magnesium in Canadian Drinking Water Supplies,
W81-03111 5A

HOLLAND AND HART, DENVER, CO.
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W81-03108 6E

HORN POINT ENVIRONMENTAL LAB., CAMBRIDGE, MD.
Distribution and Seasonality of Macroalgae on Oyster Communities of Central Chesapeake Bay,
W81-03213 2L

HYDRO-PLAN ENGINEERING LTD., TEL AVIV (ISRAEL). (ASSIGNEE).
Drip Irrigation System,
W81-03028 3F

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Guide Manual for Preparation of Water Balances,
W81-02971 6A

ILLINOIS STATE WATER SURVEY, URBANA.
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W81-03144 5B

ILLINOIS UNIV. AT URBANA-CHAMPAGIN. DEPT. OF CIVIL ENGINEERING.
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W81-03087 5A

ILLINOIS UNIV. AT URBANA. CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Reaction of Free Chlorine with Humic Substances before and after Adsorption on Activated Carbon,
W81-03086 5F

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W81-02940 5G

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W81-03215 5D

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Evaluation of Lipids and Their Elimination in Different Types of Small Capacity Purification Stations. (Inventaire Des Lipides et Leur Elimination au Niveau de Differents Types de Stations D'Epuration de Petite Capacite),
W81-03216 5D

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The Determination of Soil-Water Desorption Curves for Soil Cores,
W81-03232 2G

INSTITUTE OF GAS TECHNOLOGY, CHICAGO, IL.
Anaerobic Processes,
W81-03167 5G

INSTITUTE OF LIMNOLOGY, NORRTALJE (SWEDEN).
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W81-02908 5A

KEWANEE INDUSTRIES, BRYN MAWR, PA. (ASSIGNEE).
Flocculants for Aqueous Systems,
W81-03023 5F

KEYES ASSOCIATES, PROVIDENCE, RI.
A Review of Water Quality Problems Caused by Various Open Distribution Storage Reservoirs,
W81-03218 5B

KIMBALL (L. ROBERT) AND ASSOCIATES, EBENSBURG, PA.
Demonstration of Debris Basin Effectiveness in Sediment Control,
W81-02936 5G

KRAFT, INC., GLENVIEW, IL.
Dariy Wastes,
W81-03182 5D

KRAMER, CHIN AND MAYO, INC., SEATTLE, WA.
Fruit, Vegetable, and Grain Processing Wastes,
W81-03180 5D

KURITA WATER INDUSTRIES LTD., OSAKA (JAPAN). (ASSIGNEE); AND SANYO CHEMICAL INDUSTRIES LTD., KYOTO (JAPAN). (ASSIGNEES).
Water Treating Process,
W81-03024 5F

LA TROBE UNIV., BUNDOORA (AUSTRALIA). DEPT. OF BOTANY.
Thermophilic Fungi Isolated from a Heated Aquatic Habitat,
W81-03135 5C

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York,
W81-03098 5A

LANCASTER UNIV., BAILRIGG (ENGLAND). DEPT. OF ENVIRONMENTAL SCIENCES.
Plutonium Transport to and Deposition and Immobility in Irish Sea Intertidal Sediments,
W81-03109 5B

LOUISVILLE WATER CO., KY.
Use of Chlorine Dioxide, Chloramines, and Short-Term Free Chlorination as Alternative Disinfectants,
W81-03075 5F

MADISON METROPOLITAN SANITARY DISTRICT, WI.
Land Treatment Uses Sludge at Madison, Wisconsin,
W81-03189 5D

MANITOBA UNIV., WINNIPEG. DEPT. OF BOTANY.
Purification and Reclamation of Farm and Urban Wastes by Euglena Gracilis: Photosynthetic Capacity, Effect of pH, Temperature, Acetate and Whey,
W81-03090 5D

MANKATO STATE UNIV., MN. DEPT. OF BIOLOGICAL SCIENCES.
A Limnological Compilation of Water Quality of the Minnesota River Watershed, in Minnesota,
W81-02904 5A

MARIE CURIE-SKLODOWSKA UNIV., LUBLIN (POLAND).
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W81-03240 5D

MARYLAND UNIV., FROSTBURG. APPALACHIAN ENVIRONMENTAL LAB.
Economic Implications of a Management-Oriented Remote Sensing Program,
W81-03195 7B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. RALPH M. PARSONS LAB. FOR WATER RESOURCES AND HYDRODYNAMICS.
Comment on 'An Evaluation of Marginal Waters as a Natural Resource in Israel' By N. Buras and P. Darr,
W81-03149 3C

MASSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.
Cost Effective Stream and Effluent Monitoring,
W81-02901 5A

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W81-03226 2H

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, IL.
Denitrification,
W81-03168 5D

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF ENTOMOLOGY.
Effects of Waste Water Spray Irrigation on Idigenous Mosquito Populations,
W81-02934 5C

MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON. DEPT. OF BIOLOGICAL SCIENCES.
Evolution of Management Policy and Research in the National Parks.
W81-03120 6G

MICHIGAN WATER TREATMENT PLANT, MONROE.
The Anatomy of an Ozone Plant,
W81-03077 5F

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W81-03222 2H

MINNESOTA UNIV.-DULUTH. DEPT. OF PHYSICS.
Sources and Transports of Coal in the Duluth-Superior Harbor,
W81-02953 5B

MINNESOTA UNIV., DULUTH. LAKE SUPERIOR BASIN STUDIES CENTER.
Algal Bioassays with Leachates and Distillates from Western Coal,
W81-02937 5C

MINNESOTA UNIV., ST. PAUL. DEPT. OF ENTOMOLOGY, FISHERIES, AND WILDLIFE.
Direct Photolysis of Hexacyanoferrate Complexes; Proposed Applications to the Aquatic Environment,
W81-02945 5B

MISSOURI UNIV.-COLUMBIA. DEPT. OF CIVIL ENGINEERING.
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W81-03190 5D

MISSOURI UNIV.-COLUMBIA. SCHOOL OF FORESTRY, FISHERIES AND WILDLIFE.
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W81-02939 2I

MISSOURI UNIV., KANSAS CITY.
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W81-03162 5B

MISSOURI WATER RESOURCES RESEARCH CENTER, COLUMBIA.
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W81-03002 5C

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W81-02958 5C

MONTGOMERY (JAMES M.), PASADENA, CA.
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W81-03171 5D

MONTPELLIER-2 UNIV. (FRANCE). LAB. DE GENIE CHIMIQUE, TRAITEMENT ET EPURATION DES EAUX.
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W81-03147 5D

MOSUL UNIV. (IRAQ). DEPT. OF CHEMISTRY.
Spectrophotometric Determination of Nitrite in Waters,
W81-03127 5A

MOTOROLA, INC., SCHAUMBURG, IL. (ASSIGNEE).
Computer-Controlled Irrigation System,
W81-03016 3F

NATIONAL BOARD OF FISHERIES, GOETEBORG (SWEDEN). INST. OF HYDROGRAPHIC RESEARCH.
The Simultaneous Analysis of Total Nitrogen and Total Phosphorus in Natural Waters,
W81-03103 7B

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The Development of an Aqueous Trace Organic Standard Reference Material for Energy Related Applications: Investigation of the Aqueous Solubility Behavoir of Polycyclic Aromatic Hydrocarbons,
W81-02943 5A

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., NEW YORK.
Pulp and Paper Industry Waste Water Management,
W81-03185 5D

NATIONAL FISHERIES RESEARCH CENTER, SEATTLE, WA.
Etiology of Gas Bubble Disease,
W81-03241 5C

Atmospheric Gas Supersaturation: Educational and Research Needs,
W81-03245 5C

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W81-03037 5D

An Introduction to Water Renovation and Reclamation,
W81-03038 5D

Clarification,
W81-03039 5D

Quality Equalization,
W81-03040 5D

Ammonia Stripping,
W81-03041 5D

Softening and Recarbonation,
W81-03042 5D

Filtration,
W81-03043 5D

Chlorine Disinfection,
W81-03044 5D

Ozone Disinfection,
W81-03045 5D

Active Carbon Adsorption,
W81-03046 5D

Sludge Dewatering,
W81-03047 5D

Carbon Regeneration,
W81-03048 5D

Final Treatment,
W81-03049 5D

Operational Guidelines,
W81-03050 5D

Health Aspects,
W81-03051 5D

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.
Feasibility of Siphons for Degassing Water,
W81-03248 8I

NATIONAL SWEDISH ENVIRONMENT PROTECTION BOARD, UPPSALA. WATER QUALITY LAB.
Variability in Ionic Composition of Swedish Lakes and Rivers,
W81-03197 5A

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO).
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W81-03224 2H

NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OH.
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W81-03148 6E

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. HYDROLOGIC RESEARCH LAB.
Design of Precipitation Networks,
W81-03121 2B

NEVADA UNIV. SYSTEM, RENO. WATER RESOURCES CENTER.
Unsaturated Flow in an Arid Environment,
W81-02911 2F

NEW HAVEN WATER CO., CT.
Watershed Management,
W81-03221 5G

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO. DEPT. OF CHEMISTRY.
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W81-02902 5B

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W81-03203 5C

NEW ORLEANS UNIV., LA. DEPT. OF CIVIL ENGINEERING.
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W81-03187 5G

NEWCASTLE UNIV. (AUSTRALIA). DEPT. OF CHEMISTRY.
The Effect of pH on the Retention of Cu, Pb, Zn and Cd by Clay-Humic Acid Mixtures,
W81-03205 5B

Influence of Humate-Solute Interactions on Aqueous Heavy Metal Ion Levels,
W81-03211 5B

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W81-03175 5D

NORTH CAROLINA UNIV. AT CHAPEL HILL.
Reducing Waste Water from Cucumber Pickling Process by Controlled Culture Fermentation.
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Inorganics.
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W81-03095 5C

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Liquid Chromatographic Determination of Selected Carbamate Pesticides in Water with Electrochemical Detection,
W81-03014 5A

NORTH DAKOTA UNIV., GRAND FORKS. DEPT. OF BIOLOGY.
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W81-03250 2D

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W81-02974 2I

NOTRE DAME UNIV., IN. DEPT. OF CIVIL ENGINEERING.
Fermentation Industry,
W81-03181 5D

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Rates of Microbial Transformation of Polycyclic Aromatic Hydrocarbons in Water and Sediments in the Vicinity of a Coal-Coking Waste Water Discharge,
W81-03131 5D

OHIO STATE UNIV., COLUMBUS. DEPT. OF MICROBIOLOGY.
Analytical Note: Catalytic Effects of Sulfur and Other Compounds in the Azide-Iodine Test,
W81-03146 8A

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRICULTURAL ENGINEERING.
Reservoir Release Water Quality Improvement by Localized Destratification,
W81-03005 5G

ONTARIO MINISTRY OF NATURAL RESOURCES, SUDBURY.
Enhancement of the Survival of Rainbow Trout (Salmo Gairdneri) Eggs and Fry in an Acid Lake through Incubation in Limestone,
W81-03115 5G

ONTARIO MINISTRY OF THE ENVIRONMENT, REXDALE. LIMNOLOGY AND TOXICITY SECTION.
Crustacean Zooplankton Communities of Acidic, Metal-Contaminated Lakes Near Sudbury, Ontario,
W81-03114 5C

ORANGE-LOS ANGELES COUNTIES, CA. WATER REUSE STUDY.
Water Reuse: Projecting Markets and Costs,
W81-03072 3C

OREGON STATE UNIV., CORVALLIS. DEPT. OF MICROBIOLOGY.
Failure of the Most-Probable-Number Technique to Detect Coliforms in Drinking Water and Raw Water Supplies.
W81-03091 5A

OREGON STATE UNIV., CORVALLIS. SCHOOL OF OCEANOGRAPHY.
The Activity of NaCl in Seawater of 10-40% Salinity and 5-25C at 1 Atmosphere.
W81-03104 5A

OTTAWA UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
Shorelines Management in France: A Comment on Recent Regulations,
W81-03198 6G

PASSAVANT-WERKE MICHELBACHER HUETTE, AARBERGEN (GERMANY, F.R.).
Process for Slow Softening Water,
W81-03021 5F

PENNSYLVANIA COOPERATIVE FISHERY RESEARCH UNIT, UNIVERSITY PARK.
Probable Effects of Acid Precipitation on Pennsylvania Waters,
W81-02957 5C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.
The Effect of Soil on the Renovation of Acid Coal Mine Drainage Water,
W81-03012 5D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. SCHOOL OF FOREST RESOURCES.
Prediction of Songbird Responses to Habitat Alteration Resulting from Waste Water Irrigation,
W81-03007 5C

PENNWALT CORP., KING OF PRUSSIA, PA. CENTRAL RESEARCH AND DEVELOPMENT DEPT.
Development of Non-Fouling Piezoelectric Ultrafiltration Membranes,
W81-02975 3A

PHILADELPHIA SUBURBAN WATER CO., BRYN MAWR, PA.
Experience with Chloramines as Primary Disinfectants,
W81-03076 5F

PORTLAND STATE UNIV., OR. DEPT. OF CHEMISTRY.
Free, Proteinaceous, and Humic-Bound Amino Acids in River Water Containing High Concentrations of Aquatic Humus,
W81-03099 7B

PRINCETON UNIV., NJ. DEPT. OF CIVIL ENGINEERING.
Bifurcation Analysis of Rainfall Infiltration,
W81-03065 2A

PRODUITS CHIMIQUES UGINE KUHLMANN, PARIS (FRANCE). (ASSIGNEE).
Process for Biological Denitrification of Effluents,
W81-03020 5D

PULP AND PAPER RESEARCH INST. OF CANADA, POINTE CLAIRE (QUEBEC).
Effect of Hardwood Chlorination Conditions on the Formation of Toxic Chlorinated Compounds,
W81-03096 5D

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF CIVIL ENGINEERING.
Unsteady Sediment Transport Law and Prediction of Aggradation Parameters,
W81-03053 2J

PURDUE RESEARCH FOUNDATION, LAFAYETTE, IN. (ASSIGNEE).
Treatment of Metal Plating Wastes with an Unexpanded Vermiculite Cation Exchange Column,
W81-03031 5D

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ECONOMICS.
Implication of Recent User Charge Legislation for Barge Transportation of Agricultural Commodities,
W81-03009 6B

PURDUE UNIV., LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
Calibration and Sensitivity Analysis of the Storm Continuous Flow Simulation Model (In French),
W81-03010 2A

QUEEN'S UNIV., BELFAST (NORTHERN IRELAND). DEPT. OF INDUSTRIAL CHEMISTRY.
Principles of Dye Removal from Textile Effluent,
W81-03249 5D

RENSSELAER POLYTECHNIC INST., TROY, NY.
Disinfection,
W81-03172 5F

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF CHEMICAL ENGINEERING.
Monitoring for Land Application of Waste Water,
W81-03210 5E

RHODE ISLAND UNIV., KINGSTON.
Removal of Halomethanes from Water With Ozonation,
W81-03001 5F

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.
The Biodegradation of 2,4,6-Trichlorophenol in the Delaware River Water and Sediments and in Urban Runoff,
W81-02909 5B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Erosional Potential of Streams in Urbanizing Areas,
W81-03011 2J

SALEM AND BEVERLY WATER SUPPLY BOARD, BEVERLY, MA.
Management of Water Quality and Treatment,
W81-03219 5F

SAN DIEGO STATE UNIV., CA. DEPT. OF BIOLOGY.
Algal Mat Productivity: Comparisons in a Salt Marsh,
W81-03194 2L

SANGAMON STATE UNIV., SPRINGFIELD, IL. MATH SYSTEMS PROGRAM.
Methods for Estimating the Number of Identifiable Organic Pollutants in the Aquatic Environment,
W81-03069 5A

SCIENCE AND EDUCATION ADMINISTRATION, AKRON, CO. CENTRAL GREAT PLAINS RESEARCH STATION.
Reducing Drought Effects on Croplands in the West-Central Great Plains,
W81-02964 3F

SCIENCE AND EDUCATION ADMINISTRATION, DURANT, OK. SOUTHERN PLAINS WATERSHED AND WATER QUALITY LAB.
A Theoretical Analysis of Interflow of Water through Surface Soil Horizons with Implications for Movement of Chemicals in Field Runoff,
W81-03057 2G

SCIENCE AND EDUCATION ADMINISTRATION, MINNEAPOLIS, MN.
Hydraulics of Closed Conduit Spillways, Part XVI: Elbows and Transitions for the Two-Way Drop Inlet.
W81-02963 8B

SCIENCE AND EDUCATION ADMINISTRATION, MORGANTOWN, WV.
Spray Irrigation--A Land Disposal Practice for Decontaminating Leachate from Sanitary Landfills,
W81-02962 5D

SCIENCE AND EDUCATION ADMINISTRATION, PHILADELPHIA, PA. EASTERN REGIONAL RESEARCH CENTER.
Innovative Destruction of Complex Industrial Wastes - Auto Oxidation of Tannery Beamhouse Waste Water,
W81-02960 5D

SCIENCE AND EDUCATION ADMINISTRATION, PHOENIX, AZ. WATER CONSERVATION LAB.
Underground Travel of Renovated Waste Water,
W81-03113 3C

SCIENCE AND EDUCATION ADMINISTRATION, TEMPLE, TX. GRASSLAND, SOIL AND WATER RESEARCH LAB.
Stochastic Simulation of Daily Precipitation, Temperature, and Solar Radiation,
W81-03063 2B

SCIENCE AND EDUCATION ADMINISTRATION, TIFTON, GA.
Concentrations of Ethoprop in the Soil and Runoff Water of a Small Agricultural Watershed,
W81-02965 5B

SEWER SYSTEM EVALUATIONS, INC., CHICAGO, IL.
Wastewater Collection,
W81-03173 5D

SHELL OIL CO., NEW ORLEANS, LA.
Bottled Water: Expensive Groundwater,
W81-03153 5A

SIMON BOLIVAR UNIV., CARACAS (VENEZUELA).
Physically Based Probabilistic Models of Infiltration, Soil Moisture, and Actual Evapotranspiration,
W81-03059 2G

SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF CHEMISTRY.
Rainfall Input of Toxaphene to a South Carolina Estuary,
W81-03193 5B

SOUTHERN NEVADA WATER SYSTEM, BOULDER CITY. LAS VEGAS VALLEY WATER DISTRICT.
A Pilot Study of Chlorine Dioxide Use to Reduce Total Trihalomethanes,
W81-03074 5F

SOUTHERN RESEARCH INST. BIRMINGHAM, AL.
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances.
W81-03004 3A

ST. LOUIS COUNTY WATER CO., MO.
The NAS Water Treatment Chemical Study...What Is Its Approach. Where Will It Lead.,
W81-03141 5F

STATE UNIV. OF NEW YORK AT SYRACUSE. COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY.
Toxicity Reduction through Chemical and Biological Modification of Spent Pulp Bleaching Liquors.
W81-02935 5D

STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE.
Composition of the Earthworm Eisenia Foetida (Savigny) and Assimilation of 15 Elements from Sludge during Growth,
W81-03125 5C

SUNTECH, INC., PHILADELPHIA, PA. (ASSIGNEE).
Oil Spill Cleanup Method and Apparatus,
W81-03026 5G

SWEDISH WATER AND AIR POLLUTION RESEARCH INST., GOETEBORG.
A Method for Evaluating the Acid-Base Balance in Natural Waters,
W81-03212 5A

TAHAL CONSULTING ENGINEERS, LTD., TEL AVIV (ISREAL).
Advanced Municipal Waste Water Treatment by a Single Stage Activated Sludge System,
W81-03155 5D

TECHNION-ISRAEL INST. OF TECH., HAIFA.
Studies on Lake Kinneret (Sea of Galilee) Watershed. I. Characterization of Water and Suspended Load in Lake Kinneret Tributaries,
W81-03083 5B

Studies on Lake Kinneret (Sea of Galilee) Watershed. II. Nitrification and Self-Purification Processes in the Jordan Canyon,
W81-03084 5B

TENNESSEE VALLEY AUTHORITY, CHATTANOOGA.
Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling,
W81-02968 5D

TEXAS A AND M UNIV., COLLEGE STATION.
Water Treatment Project: Observations on Use of GAC in Practice,
W81-02966 5F

TEXAS A AND M UNIV., COLLEGE STATION. WATER RESOURCES INST.
Contaminant Transport in Hydrogeologic Systems,
W81-02907 5B

THETFORD CORP., ANN ARBOR, MI. (ASSIGNEE).
Closed Loop Waste Treatment and Water Recycling Toilet System,
W81-03030 5D

TRW, INC., REDONDO BEACH, CA.
Surface Containment for Geothermal Brines,
W81-02955 5G

TUFTS UNIV., MEDFORD, MA. DEPT. OF CIVIL ENGINEERING.
Process Spill Monitoring, Control and Recovery in the Pulp and Paper Industry,
W81-02942 5D

UNITY COLL., ME.
Internal Heavy Metal Changes as a Consequence of Exposure of Mytilus Edulis, the Blue Mussel, to Elevated External Copper(II) Levels,
W81-03124 5C

UNIVERSITE DE BRETAGNE-OCCIDENTALE, BREST (FRANCE). LAB. DE CHIMIE ANALYTIQUE.
Study of the Chlorination of Artificial Seawater. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificielle),
W81-03110 5F

UNIVERSITE DE BRETAGNE-OCCIDENTALE, BREST (FRANCE). LAB. DE CHIMIE

Physicochemical Study of the Chlorination of Artificial Sea Water Containing Ammoniacal Nitrogen. (Etude Physicochimique De La Chloration De L'Eau De Mer Artificiell Contenant De L'Azote Ammoniacal),
W81-03145 5F

UNIVERSITY OF CENTRAL FLORIDA, ORLANDO. DEPT. OF ECONOMICS.
Economic Analysis of Rural Sludge Management,
W81-02933 5E

UNIVERSITY OF SOUTH FLORIDA, TAMPA. DEPT. OF BIOLOGY.
Diurnal Variation of Selected Parameters Under Waterhyacinths and in Open Water,
W81-03101 2H

UNIVERSITY OF WEST FLORIDA, PENSACOLA. DEPT. OF BIOLOGY.
Isolation of Vibrio Cholerae Serotype 01 from the Eastern Oyster, Crassostrea Virginica,
W81-03128 5A

UOP INC., ST. PAUL, MN. JOHNSON DIV.
Pumping Test Analyses for Low Yield Formations,
W81-03229 7B

UTAH STATE UNIV., LOGAN. DIV. OF ENVIRONMENTAL ENGINEERING.
Lagoons and Oxidation Ponds,
W81-03166 5D

UTAH WATER RESEARCH LAB., LOGAN.
Characteristics of Nonpoint Source Urban Runoff and Its Effects on Stream Ecosystems,
W81-02969 5C

VERSAR, INC., SPRINGFIELD, VA.
Removal of Fluorides from Industrial Waste Waters using Activated Alumina,
W81-02970 5D

VICTORIA UNIV. (BRITISH COLUMBIA). DEPT. OF CHEMISTRY.
Fluoride Distribution and Dispersion Processes About an Industrial Point Source in a Forested Coastal Zone,
W81-03206 5B

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
An Economic Analysis Strategy for Management of Shoreline Erosion,
W81-03117 4D

Law,
W81-03160 6E

Characterization and Agricultural Utilization of Swine Waste Lagoon Effluents,
W81-03208 3C

WEATHER SERVICE FORECAST OFFICE, PHOENIX, AZ.
The Marine Layer at San Diego, California, as Related to Subsequent Cool Season Precipitation Forecasts in Arizona,
W81-03122 2B

WILLDAN ASSOCIATES, PHOENIX, AZ.
Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 1: Synthesis Papers,
W81-02972 6G

Texas Barrier Islands Region Ecological Characterization: A Socioeconomic Study, Volume 2: Data Appendix,
W81-02973 6G

WISCONSIN UNIV.-MADISON.
Epidemiologic Studies of Virus Transmission in Swimming Waters,
W81-02967 5C

On-Site Alternatives for Treatment and Disposal,
W81-03170 5D

WISCONSIN UNIV.-MADISON. DEPT. OF GEOGRAPHY.
Effects of Climatic Variation and Land Use Changes on Sediment Production from Upper Black Earth Creek, Wisconsin,
W81-03003 2J

WISCONSIN UNIV.-MADISON. LAB. OF HYGIENE.
Poor Sludge Settleability Caused by the Bacterium Lampropedia,
W81-03139 5D

WISCONSIN UNIV.-SUPERIOR. DEPT. OF BIOLOGY.
Influence of Advanced Waste Water Treatment on the Fishery Resource of Shagawa Lake, Minnesota,
W81-02951 5C

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Long-Term Effects of the Barge Florida Oil Spill,
W81-02938 5C

ACCESSION NUMBER INDEX

W81-02901 5A
W81-02902 5B
W81-02903 3A
W81-02904 5A
W81-02905 5D
W81-02906 6E
W81-02907 5B
W81-02908 5A
W81-02909 5B
W81-02910 6E
W81-02911 2F
W81-02912 2J
W81-02913 5G
W81-02914 7C
W81-02915 4B
W81-02916 2E
W81-02917 7C
W81-02918 7C
W81-02919 7C
W81-02920 7C
W81-02921 7B
W81-02922 7C
W81-02923 2A
W81-02924 5C
W81-02925 7C
W81-02926 5B
W81-02927 6B
W81-02928 7C
W81-02929 2E
W81-02930 1A
W81-02931 5C
W81-02932 2F
W81-02933 5E
W81-02934 5C
W81-02935 5D
W81-02936 5G
W81-02937 5C
W81-02938 5C
W81-02939 2I
W81-02940 5G
W81-02941 5A
W81-02942 5D
W81-02943 5A
W81-02944 5D
W81-02945 5B
W81-02946 7B
W81-02947 5C
W81-02948 5C
W81-02949 3E
W81-02950 5G
W81-02951 5C
W81-02952 5B
W81-02953 5B
W81-02954 5B
W81-02955 5G
W81-02956 5C
W81-02957 5C
W81-02958 5C
W81-02959 5G
W81-02960 5D
W81-02961 5B
W81-02962 5D
W81-02963 8B
W81-02964 3F
W81-02965 5B
W81-02966 5F
W81-02967 5C
W81-02968 5D
W81-02969 5C
W81-02970 5D
W81-02971 6A
W81-02972 6G
W81-02973 6G
W81-02974 2I
W81-02975 3A
W81-02976 5B
W81-02977 7C
W81-02978 7C
W81-02979 7C
W81-02980 2E
W81-02981 2E
W81-02982 5A
W81-02983 7C
W81-02984 7C
W81-02985 2E
W81-02986 5A
W81-02987 8C
W81-02988 5A
W81-02989 5E
W81-02990 1A
W81-02991 7C
W81-02992 5B
W81-02993 2F
W81-02994 2L
W81-02995 5A
W81-02996 7C
W81-02997 7C
W81-02998 7C
W81-02999 7C
W81-03000 7C
W81-03001 5F
W81-03002 5C
W81-03003 2J
W81-03004 3A
W81-03005 5G
W81-03006 3C
W81-03007 5C
W81-03008 5A
W81-03009 6B
W81-03010 2A
W81-03011 2J
W81-03012 5D
W81-03013 5A
W81-03014 5A
W81-03015 3F
W81-03016 3F
W81-03017 3F
W81-03018 5D
W81-03019 5D
W81-03020 5D
W81-03021 5F
W81-03022 5D
W81-03023 5F
W81-03024 5F
W81-03025 5D
W81-03026 5G
W81-03027 3F
W81-03028 3F
W81-03029 3A
W81-03030 5D
W81-03031 5D
W81-03032 5D
W81-03033 5F
W81-03034 5D
W81-03035 5G
W81-03036 5G
W81-03037 5D
W81-03038 5D
W81-03039 5D
W81-03040 5D
W81-03041 5D
W81-03042 5D
W81-03043 5D
W81-03044 5D
W81-03045 5D
W81-03046 5D
W81-03047 5D
W81-03048 5D
W81-03049 5D
W81-03050 5D
W81-03051 5D
W81-03052 3F
W81-03053 2J
W81-03054 2G
W81-03055 5F
W81-03056 2G
W81-03057 2G
W81-03058 2F
W81-03059 2G
W81-03060 2J
W81-03061 2F
W81-03062 5B
W81-03063 2B
W81-03064 2F
W81-03065 2A
W81-03066 2F
W81-03067 4A
W81-03068 5B
W81-03069 5A
W81-03070 2F
W81-03071 5A
W81-03072 3C
W81-03073 3D
W81-03074 5F
W81-03075 5F
W81-03076 5F
W81-03077 5F
W81-03078 5F
W81-03079 5F
W81-03080 5A
W81-03081 6B
W81-03082 6A
W81-03083 5B
W81-03084 5B
W81-03085 2G
W81-03086 5F
W81-03087 5A
W81-03088 5B
W81-03089 5B
W81-03090 5D
W81-03091 5A
W81-03092 5A
W81-03093 5C
W81-03094 5C
W81-03095 5C
W81-03096 5D
W81-03097 5F
W81-03098 5A
W81-03099 7B
W81-03100 2D
W81-03101 2H
W81-03102 6E
W81-03103 7B
W81-03104 5A
W81-03105 5A
W81-03106 5B
W81-03107 5C
W81-03108 6E
W81-03109 5B
W81-03110 5F
W81-03111 5A
W81-03112 5E
W81-03113 3C
W81-03114 5C
W81-03115 5G
W81-03116 5C
W81-03117 4D
W81-03118 5B
W81-03119 5B
W81-03120 6G
W81-03121 2B
W81-03122 2B
W81-03123 3C
W81-03124 5C
W81-03125 5C
W81-03126 8I
W81-03127 5A
W81-03128 5A
W81-03129 5A
W81-03130 5A
W81-03131 5D
W81-03132 6B
W81-03133 5D
W81-03134 4A
W81-03135 5C
W81-03136 5D
W81-03137 6A
W81-03138 5D
W81-03139 5D
W81-03140 6D
W81-03141 5F
W81-03142 5D
W81-03143 5A
W81-03144 5B
W81-03145 5F
W81-03146 8A
W81-03147 5D
W81-03148 6E
W81-03149 3C
W81-03150 5D
W81-03151 5D
W81-03152 5C
W81-03153 5A
W81-03154 8A
W81-03155 5D
W81-03156 5B
W81-03157 5A
W81-03158 6A
W81-03159 6C
W81-03160 6E
W81-03161 5A
W81-03162 5B
W81-03163 5A
W81-03164 5D
W81-03165 5D
W81-03166 5D
W81-03167 5G
W81-03168 5D
W81-03169 5D
W81-03170 5D
W81-03171 5D
W81-03172 5F
W81-03173 5D
W81-03174 5D
W81-03175 5D
W81-03176 5B
W81-03177 5D
W81-03178 5D
W81-03179 5D
W81-03180 5D
W81-03181 5D
W81-03182 5D
W81-03183 5D
W81-03184 5D
W81-03185 5D
W81-03186 5C
W81-03187 5G
W81-03188 5D
W81-03189 5D
W81-03190 5D
W81-03191 5C
W81-03192 5C
W81-03193 5B
W81-03194 2L
W81-03195 7B
W81-03196 2H
W81-03197 5A
W81-03198 6G
W81-03199 5B
W81-03200 5A
W81-03201 2L
W81-03202 5C
W81-03203 5C
W81-03204 5B
W81-03205 5B
W81-03206 5B
W81-03207 5A
W81-03208 3C
W81-03209 7C
W81-03210 5E
W81-03211 5B
W81-03212 5A
W81-03213 2L
W81-03214 5B
W81-03215 5D
W81-03216 5D
W81-03217 5C
W81-03218 5B
W81-03219 5F
W81-03220 4B
W81-03221 5G
W81-03222 2H
W81-03223 5C
W81-03224 2H
W81-03225 5D
W81-03226 2H
W81-03227 2H
W81-03228 8I
W81-03229 7B
W81-03230 3B
W81-03231 2F
W81-03232 2G
W81-03233 6D
W81-03234 5C
W81-03235 2H
W81-03236 2H

W81-03237 5C
W81-03238 6E
W81-03239 5D
W81-03240 5D
W81-03241 5C
W81-03242 5C
W81-03243 5C
W81-03244 5C
W81-03245 5C
W81-03246 5C
W81-03247 5D
W81-03248 8I
W81-03249 5D
W81-03250 2D

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Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

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A10	17.00	E10	22.50	T10	660.00		
A11	18.50	E11	24.50	T11	720.00		
A12	20.00	E12	27.50	T12	780.00		
A13	21.50	E13	30.50	T13	840.00		
A14	23.00	E14	33.50	T14	900.00		
A15	24.50	E15	36.50	T15	960.00		
A16	26.00	E16	39.50	T16	1,020.00		
A17	27.50	E17	42.50	T17	1,080.00		
A18	29.00	E18	45.50	T18	1,140.00		
A19	30.50	E19	50.50	T19	1,200.00		
A20	32.00	E20	60.50	T99	*		
A21	33.50	E99	*				
A22	35.00						
A23	36.50	N01	30.00				
A24	38.00	N02	50.00				
A25	39.50						
A99	*						

*Contact NTIS for price quote

PRICES EFFECTIVE JANUARY 1, 1981